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OPERATIONS RESEARCH
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Reactions of Troops in Atomic Maneuvers

Exercise DESERT ROCK IV

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Abstract

REACTIONS OF TROOPS IN ATOMIC MANEUVERS Exercise DESERT ROCK IV

by

Suzanne G. Billingsley
John C. Fallock
Alfred H. Hansmith

The emotional reactions and attitudes of troops toward atomic dangers are studied in this memorandum, a continuation of CRO's investigation of the effects on troops of participation in the atomic maneuvers at Desert Rock. Methods of study included polygraph tests, interviews, a performance test, and questionnaires administered during Exercise DESERT ROCK IV, April through June 1953. Comparisons were made of the reactions of members of airborne infantry, regular infantry, armored infantry, and service units; between maneuver participants and non-participants; between regularly indoctrinated and minimally indoctrinated troops; and between troops who had had previous experience in atomic maneuvers and those who had not. Conclusions and recommendations include:

- Emotional reactions toward atomic dangers were not changed appreciably as a result of participation in Exercise DESERT ROCK IV.
- No consistent differences were found in emotional reactions or attitudes of the various Army units studied.
- Questions relating to combat dangers elicited a larger emotional reaction than did questions concerning atomic dangers.
- In view of the lack of changes in troops' emotional reactions to the A-bomb, it is suggested that the Army determine whether values achieved by large-scale troop participation in atomic maneuvers justify their cost.

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Technical Memorandum ORD-T-240



Reactions of Troops in Atomic Maneuvers

Exercise DESERT ROCK IV

by

Seamus G. Billingsley
John C. Bullock
Alfred H. Hauerath

OPERATIONS RESEARCH OFFICE
The Johns Hopkins University Chevy Chase, Maryland

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CONTENTS

	Page
ABSTRACT	iii
ACKNOWLEDGMENTS	vii
SUMMARY	1
Problem--Facts--Discussion--Conclusions-- Recommendations	
INTRODUCTION	7
The Problem--Exercise DESERT ROCK IV-- Description of Research Methods	
SUMMARY OF FINDINGS	13
Effects of Participation--Reactions of Different Types of Troops--Effects of Indoctrination-- Delayed Reactions--Reactions to Atomic versus Combat Dangers--Effects on Performance	
INTERPRETATION OF RESULTS	19
Behavioral Evidence--Verbal Evidence--Physio- logical Evidence--DESERT ROCK IV versus DESERT ROCK I Findings--Evaluation of Desert Rock Maneuvers	
RECOMMENDATIONS	24
APPENDICES	
A. THE POLYGRAPH MEASUREMENTS	25
B. INTERVIEWS WITH INDIVIDUAL PARTICIPANTS	73
C. THE QUESTIONNAIRE RESPONSES	91
D. THE PERFORMANCE TEST	101

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CONTENTS (Cont.)

	Page
E. OTHER STUDIES OF THE REACTIONS OF INDIVIDUALS TO AN ATOMIC EXPLOSION	107
F. METHODOLOGICAL CONSIDERATIONS	113

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SUMMARY

PROBLEM

To study the effects of participation in the 1952 series of atomic maneuvers at Desert Rock on the emotions and attitudes of troops regarding atomic dangers.

FACTS

This memorandum is a continuation of a study begun at **DESERT ROCK I (ORO-T-170), Troop Performance on a Training Maneuver Involving the Use of Atomic Weapons, March 1952, SECRET**, in which polygraph blood pressure records gave indication of some underlying tensions in airborne infantry taking part in the first atomic maneuver conducted at the Nevada test site. In the present study the scope of investigation was broadened by inclusion of subjects from other types of Army units, engaging in the somewhat more elaborate and realistic maneuvers of Exercise **DESERT ROCK IV** (April through June 1952).

DISCUSSION

The subjects tested by ORO at **DESERT ROCK IV** were selected to allow comparison of the reactions and attitudes of members of airborne infantry, regular infantry, armored infantry, and service units; comparisons between maneuver participants and non-participants; between troops who had received regular indoctrination in atomic effects and those who had been given only minimal safety instruction; and between troops who had previously experienced atomic maneuvers and those who had not. Also tested were the effect of a lapse of time on the attitudes and reactions of maneuver participants to atomic dangers, and the effect of witnessing an atomic explosion on the subjects'

ORO-T. 240

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ability to perform a simple military task. The reactions of troops to atomic dangers were compared with their reactions to the dangers of ordinary combat.

The methods employed included polygraph tests which provided a record of both physiological and verbal responses, interviews with individuals, and questionnaires administered to groups. Questions were asked concerning atomic dangers, combat dangers, and irrelevant topics introduced for control purposes. The performance test was the disassembly and reassembly of the M-1 rifle.

CONCLUSIONS

1. Troops' emotional reactions toward atomic dangers were not changed appreciably as a result of participating in the DESERT ROCK IV atomic maneuvers.
2. No regular or consistent differences were found in the emotional reactions or attitudes toward atomic dangers of airborne infantry, regular infantry, armored infantry, and service troops.
3. No consistent evidence was found to indicate that the indoctrination course, given at Camp Desert Rock, affected troops' emotional reactions toward atomic dangers, either immediately following the burst, or three weeks later.
4. Troops suffered no impairment of manual dexterity in their performance of a routine military task as a function of witnessing an A-bomb burst.
5. Troops uniformly gave larger emotional reactions to questions concerning combat dangers than to questions concerning atomic dangers.
6. It is not believed that atomic maneuvers of the type held in Exercise DESERT ROCK IV, with their emphasis on safety measures and control, yield the kind of data necessary for making predictions of how troops will actually perform in combat when A-bombs are used.

RECOMMENDATIONS

1. That, in the absence of changes in troops' emotional reactions to the A-bomb as a result of participation in atomic maneuvers, the Army determine whether indoctrination, training,

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and other values achieved by large-scale troop participation in such maneuvers are sufficient to justify their cost.

2. That further studies to assess the performance and psychological reactions of troops in connection with atomic explosions be made only when troops are employed under conditions involving danger, surprise, and fatigue approximating those found in combat, or when atomic weapons are actually used in combat operations.

ORO-T-240

3

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REACTIONS OF TROOPS IN ATOMIC MANEUVERS

Exercise DESERT ROCK IV

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INTRODUCTION

THE PROBLEM

The study undertaken by ORO in connection with DESERT ROCK IV is a continuation of ORO's earlier investigation of the performance and psychological reactions of troops participating in an atomic maneuver.* It was hoped that means might be discovered for predicting the probable behavior of troops under conditions of actual atomic warfare. The significance of the earlier study was limited because the DESERT ROCK I Exercise was the first in which troops participated, only select (airborne) troops were employed, and the maneuver was unrealistic. Although in their verbal statements and in their performance of routine duties these men showed very little evidence of tension and apprehension concerning their participation in an atomic maneuver, the results of polygraph tests suggested that such feelings might in fact be present. It was assumed that such underlying tension induced by an atomic explosion might, under the more stressful conditions of combat, reach levels sufficient to impair the ability of individual soldiers to perform their duties.

It was decided, therefore, that ORO should continue the investigation of troop reactions by studying participants in three maneuvers of the DESERT ROCK IV Exercise.† The investigation was broadened by the inclusion of troops of different branches of the Army, occupying positions nearer the atomic explosion, under differing methods of bomb delivery and varying KT yields, and performing somewhat more varied maneuver tasks.

EXERCISE DESERT ROCK IV

Exercise DESERT ROCK IV was held at the Nevada test site during April, May, and June 1952. According to the report issued

*ORO-T-178, Troop Performance on a Training Maneuver Involving the Use of Atomic Weapons, March 1952, SECRET.

† For a summary of other studies of the reactions of individuals to atomic explosions, see Appendix K.

by Brig Gen H. P. Storks, Exercise Director, the mission of this exercise was "...with the maximum Army participation possible, to provide indoctrination training in tactical operations featuring tactical employment of atomic devices, to provide training in essential protective measures, to observe psychological effects of atomic explosion on individuals, and, in a lesser degree than in Exercise DESERT ROCK I, II, and III, to provide indoctrination training in the effects of atomic explosion on equipment, materiel, and emplacements."² Of the four exercise maneuvers, ORO participated in all three involving Army troops, but did not participate in the one maneuver in which Marines were used.

The tactical setting for each of the DESERT ROCK IV maneuvers predicated that, since friendly units had been unable to force a breakthrough into enemy-held territory, an atomic weapon was to be used to clear the way for penetration into enemy rear areas. After participating troops had prepared and occupied fox-holes approximately 7000 yards from the assumed enemy lines, an A-bomb was exploded. Army personnel studied by ORO participated in the following subsequent movements: after Shot 3 (an air-drop), an airborne unit made a parachute drop in the rear of the enemy position and other airborne and regular infantry units advanced on foot through the ground zero area to link up. After Shot 6 (a tower detonation simulating an artillery burst) Army CBR (chemical, biological, and radiological) monitors were for the first time permitted to monitor alone. When they had given the all-clear signal, an armored battalion combat team (BCT) advanced toward ground zero. Immediately following Shot 8 (a tower shot), a BCT composed of Engineer Amphibious Support Troops (augmented) began a tactical march without waiting for prior rad-safe (Radiological Safety) clearance from the AEC or Army CBR monitors, depending instead on Army monitors advancing in front of the unit. The unit was accompanied by tanks, the crews of which had been in their vehicles at 7000 yards from ground zero during the explosion.

These maneuvers were more realistic than DESERT ROCK I in that troops were 4000 yards closer to ground zero at the time of the explosions, they were permitted to advance more quickly after the bursts and to approach closer to ground zero, and Army personnel were given greater responsibility for determining radiological safety. Essentially, however, the troops were still primarily spectators and the maneuvers were not realistic tactical exercises.

²Exercise DESERT ROCK IV April-June 1952, H. P. Storks, Brig Gen, USA, p 7, SECRET, Restricted Data, Atomic Energy Act 1946.

DESCRIPTION OF RESEARCH METHODS

The following methods were employed in the ORO studies:

1. Individual polygraph tests on troops, in which the subject's physiological reactions as well as his verbal responses to questions pertaining to A-bomb, combat, and other situations were recorded. (See Appendix A for full description.)

2. Interviews with individuals, in which verbal responses of troops were recorded by the interviewer. (See Appendix B for full description.)

3. A questionnaire, administered to troops assembled in groups, in which troops were asked to respond to questions concerning their information and attitudes about the A-bomb. (See Appendix C for full description.)

4. A performance test, administered to troops in groups of 25, involving the disassembly and reassembly of the M-1 rifle. (See Appendix D for full description.)

Polygraph Tests

The bulk of the data used in this study consisted of polygraph measurements of troop reactions to a set of questions relating to atomic dangers, combat dangers, and a few irrelevant topics introduced for control purposes. Two types of data resulted: (a) The continuous record of changes in the subject's blood pressure and breathing during the test period, that is, his physiological reactions to the stimuli of the questions. (Rise in relative blood pressure was used as the measure of physiological reaction.) (b) The verbal responses (Yes or No) in answer to the questions. A word association test was also employed with the polygraph, the subject being asked to respond to the test word with the first word which came into his mind; this produced no significant results.

Polygraph tests were made on the following groups* for the purposes stated:

1. To study the effects of participation in the exercise on the responses of different types of troops:

Twenty enlisted men from the 135th Infantry Regiment, 47th Infantry Division and nineteen enlisted men from the 504th Airborne Infantry Regiment, 82d Airborne Division were tested during the three days before Shot 3 and re-tested after the maneuver on D Day and during the follow-

*Polygraph tests were obtained in most cases on larger groups of subjects than are indicated here; however, it was necessary to discard some of the records for purposes of statistical analysis. See Appendix A for discussion of reductions in sample size.

ing day. Blood pressure and verbal records were secured from each.

2. To study the effects on troop attitudes and reactions of participation in an atomic maneuver, of minimal and of full atomic indoctrination, and of a lapse of time following the maneuver experience, groups were drawn from the 1st Armored Division (home station, Ft Hood):

Group P-1 who participated in Shot 6 after receiving the regular atomic indoctrination were tested at Ft Hood on D minus 11 and retested at Ft Hood on D plus 2; 27 blood pressure records and 35 verbal records were obtained.

Group N-1, a control group who did not go to Desert Rock IV; these men were tested at Ft Hood on D minus 10 and again on D minus 4; 27 blood pressure records and 40 verbal records were obtained.

Group N-2, a control group who did not go to Desert Rock IV; the men were tested at Ft Hood on D minus 3 and again on D plus 12; 27 blood pressure records and 31 verbal records were obtained.

Group P-2R, who participated in Shot 6 after receiving the regular atomic indoctrination; the men were tested on D Day after the shot and again on D plus 19; 23 blood pressure records and 35 verbal records were secured.

Group P-3M, who participated in Shot 6 after receiving minimal atomic indoctrination were tested on D plus 1 and again on D plus 20; 26 blood pressure records and 32 verbal records were secured.

3. To compare the reactions, just prior to their participation in DESERT ROCK IV, of men who had experienced an atomic maneuver with those of men who had not yet taken part:

Twenty-one station complement personnel (service troops) who had witnessed previous shots or taken part in previous maneuvers were tested during D minus 2 and D minus 1; and thirty station complement personnel who were scheduled to take part in an atomic maneuver for the first time were tested during D minus 2 and D minus 1; blood pressure and verbal records were secured from each.

Individual Interviews

In the individual interviews, questions were asked similar to those used in the polygraph tests and the questionnaire. This method was included because it permits greater flexibility and finer distinctions since the subject can ask for explanations of

meaning and can qualify and elaborate his responses. One hundred infantrymen from the 1st Armored Division were interviewed at Camp Desert Rock during the day and a half following their participation in Shot 6. Of these, 45 had received full indoctrination on atomic effects and 55 had been given minimal instruction. During the two days prior to Shot 8, 30 service troops who had experienced an A-bomb maneuver and 30 who had not were also interviewed.

Questionnaires

Two equivalent forms of an attitude and information questionnaire, constructed by HumRRO, were administered on the day before and the afternoon following Shot 8. The questions, although much more numerous (over 100) than those asked in the polygraph tests and interviews, covered the same general areas -- the A-bomb, ordinary combat, and irrelevant questions dealing mainly with attitudes toward the Army. Multiple-choice answers were supplied. The questionnaire was scored by assigning values to 12 clusters of related questions, grouped under such headings as "Index of [atomic] Information Accuracy," "Index of Over-Estimation of [atomic] Effects," "Index of Faith in the Army." The questionnaire was answered by the same service troops who were used in the polygraph tests and interviews conducted at Shot 8 and additional men drawn from the 369th Engineer Amphibious Support Regiment, the 31st Transportation Truck Company, the 562d Transportation Staging Area Company, and the 360th Army Band. Of these subjects, 67 had had previous A-bomb experience and 30 had not.

An indication of the content of the questions used in polygraph tests, interviews, and questionnaires is given by the following questions asked in the polygraph tests at Shots 6 and 8 and, in slightly different order and wording, at Shot 3:

Sample Polygraph Questions

- | | |
|---|--|
| (a) Questions pertaining to the A-bomb. | (c) Questions pertaining to ordinary combat. |
| (b) Irrelevant questions. | |
| (d) 1. Do you think the outfit you're in is a good one? | |
| (c) 2. Do you think your outfit is ready to go into combat now if it had to? | |
| (c) 3. Do you ever worry about whether you'll be injured in combat? | |
| (a) 4. Do you think the experts know enough to use A-bombs in maneuvers without danger to our troops? | |
| (a) 5. If you were in a hole when an A-bomb went off 4 miles away, do you think you'd be scared? | |

- (a) 6. If you watched an A-bomb explode 4 miles away, do you think you'd be blinded for life?
- (a) 7. Right after an A-bomb burst at 2000 feet, would you feel safe walking through ground zero in your regular field clothing?
- (a) 8. If you were in a foxhole 4 miles from an A-bomb burst, do you think the radiation would hurt you?
- (a) 9. If a soldier got a bad case of radiation sickness, do you think he'd die?
- (i) 10. Would you say you're the type that makes a good soldier?
- (i) 11. Would you say that you're in good physical condition now?
- (c) 12. If you were sent into actual fighting now, do you think you'd do all right?
- (c) 13. If you were wounded in battle and unable to shout for help, would you be afraid that the medics might not find you?
- (c) 14. Do you ever worry about what might happen to you if you were taken prisoner by the enemy?
- (a) 15. If you were in a foxhole 4 miles away from an A-bomb explosion, do you think you'd black out or be sick?
- (a) 16. Would you feel safe in a foxhole only 2 miles away from an A-bomb burst?
- (a) 17. Would you be afraid to handle equipment within 1 1/2 miles of an A-bomb burst before it's monitored?
- (a) 18. If you were in a foxhole 4 miles from an A-bomb burst, do you think the blast would be dangerous?
- (c) 19. If you were caught in the open 4 miles away from an A-bomb burst, do you think the fire flash would burn you?
- (i) 20. If you had your choice, would you rather be in a different branch of the Army than the one you're in now?

Performance Test

The performance test with the M-1 rifle, given to troops before and after Shot 3, was introduced to determine whether witnessing an atomic explosion caused tensions which might be reflected in changes in the subjects' ability to perform military tasks involving manual dexterity. Although 99 men took part in the pre-D-Day performance test, there was time to retest only 25 of these (infantrymen of the 165th Regiment; 81st Infantry Division) immediately after the atomic explosion and before the troops advanced toward ground zero.

SUMMARY OF FINDINGS

The tests conducted by ORO were designed to secure answers to six questions relating to the psychological effects of atomic explosions on Army troops, and to the value of atomic maneuvers in which large numbers of troops take part. Summaries of the findings are given below; full descriptions of the tests and detailed analyses of the results are given in Appendices A through D.

EFFECTS OF PARTICIPATION

Are troops' emotional reactions to, and attitudes toward, atomic dangers changed as a result of participation in an atomic maneuver?

This question was approached in three ways: by studying the reactions of troops before and after they took part in an atomic maneuver; by comparing the reactions of DESERT ROCK IV participants with those of non-participant troops; and by comparing, prior to their participation in an atomic maneuver, the reactions of men who had previously had such an experience with the reactions of those who had not.

Polygraph tests given to participant troops prior to the maneuvers consistently indicated a low level of emotional reaction to atomic danger questions, and retests showed no significant changes in troops' reactions after participation in the maneuvers. The emotional reactions of participants (whether tested before or after the maneuvers) did not differ from the reactions of troops who did not participate in the maneuvers or go to Desert Rock. It was also found that, prior to participation in one of the maneuvers, troops who had had experience in previous maneuvers did not differ in their emotional reactions to the A-bomb from troops who were about to undergo this experience for the first time. The polygraph tests thus gave consistent evidence that troops' emotional reactions to atomic dangers were not essentially changed as a result of participation in the DESERT ROCK IV maneuvers.

Questionnaires administered before and after one of the maneuvers also indicated that troops' attitudes toward atomic dangers were unchanged as a result of participation, and revealed no attitudinal differences between troops who had had previous maneuver experience and those who had not.

Slightly different results were obtained from the verbal polygraph records and interview data. In verbal responses to the polygraph questions, no consistent patterns of apprehension concerning A-bomb dangers emerged. Tests given to men before and after maneuvers indicated that participation resulted in a decrease in the number of troops verbally expressing apprehension concerning some of these atomic dangers, whereas verbal expression of fears of other dangers remained unchanged. After having taken part in an atomic maneuver, a somewhat greater proportion of the troops tested expressed confidence and lack of apprehension concerning atomic dangers than did non-participant troops. Differences between participant and non-participant troops were generally rather small, however, and on one or two questions fear was expressed by a somewhat greater number of participant than non-participant troops.

A comparison of experienced and inexperienced troops' verbal responses on the polygraph test indicated a slight but probably insignificant tendency for troops with previous A-bomb maneuver experience to express somewhat greater confidence concerning atomic dangers than troops without prior experience. In their interview responses, experienced troops consistently expressed greater boldness and confidence concerning atomic dangers than did inexperienced troops.

Evidence based on verbal responses to the polygraph test and interview questions thus would seem to suggest that participation in the DESERT ROCK IV maneuvers may have resulted in certain reductions in troops' expressed fears concerning atomic dangers. The fact that such attitudinal changes as did occur were generally rather small, and were apparently not accompanied by changes in troops' physiological-emotional reactions to A-bomb dangers, makes evidence based on the verbal data of questionable significance. Although this study does not provide consistent or definite evidence concerning the effect of participation on troops' verbally expressed attitudes regarding the A-bomb, the physiological response data show clearly that participation in DESERT ROCK IV had little or no effect on troops' emotional reactions to atomic dangers.

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REACTIONS OF DIFFERENT TYPES OF TROOPS

Do troops from different branches of the Army vary in their emotional reactions to atomic dangers?

The troops studied by ORO at DESERT ROCK I were airborne infantrymen. On the assumption that, as members of an "elite" unit, they might be atypical, men from airborne infantry, regular infantry, armored infantry, and service units were tested at DESERT ROCK IV. No regular or consistent differences appeared between the emotional reactions or verbal responses of men from these units. As might be expected, there were individual differences among soldiers in their emotional reactions to atomic dangers; but no systematic group differences were evident. Different types of troops tested at the three maneuvers did tend to vary in their emotional reactions to combat and other types of questions; these dissimilarities gave further emphasis to the marked similarity of emotional response to atomic dangers on the part of various groups of troops participating in DESERT ROCK IV.

EFFECTS OF INDOCTRINATION

Following participation in an A-bomb maneuver, do troops who have received a minimal amount of A-bomb indoctrination show different emotional reactions to, and attitudes toward, atomic dangers than troops who received full indoctrination?

At Camp Desert Rock the troops who were to take part in the atomic maneuvers were given an indoctrination course which included such subjects as a description of effects of atomic weapons, some discussion of radiological safety measures, and instruction in conduct to be followed on D Day to insure the safety of the individual. In an attempt to assess the effect of atomic energy indoctrination on the attitudes and emotional reactions of maneuver participants, this routine indoctrination was withheld from one company of armored infantry troops in Shot 6. These men received no information except brief safety instructions at the forward area on rehearsal day.

Interviews and polygraph tests were obtained after the maneuver from a group of men who had received regular indoctrination and also from a group of men in the company which had

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received "minimal" indoctrination. In polygraph tests the regularly indoctrinated troops after the maneuver showed greater blood pressure responses to atomic danger questions than did the minimally indoctrinated men. Although this might suggest that regular indoctrination heightened troops' emotional reactions to A-bomb dangers, the fact that these troops also showed greater emotional reactions concerning combat dangers than did the minimally indoctrinated men makes such an interpretation somewhat questionable. It is more likely that differences in the reactions of these two groups were a function of the time of testing: the regularly indoctrinated men were given the polygraph test on D Day soon after their return from the maneuver, whereas the minimally indoctrinated men were not tested until the next day. It is believed that fatigue and the recency of their maneuver experience probably account for the regularly indoctrinated troops' heightened emotional reactions to both atomic and combat danger questions. In their verbal responses to the A-bomb questions on the polygraph test, no differences were found between regularly and minimally indoctrinated troops.

In replies to interview questions on atomic dangers, asked of a somewhat larger group of participants during the day and a half after Shot 6, indoctrinated troops generally showed a somewhat greater degree of boldness and confidence than did the troops who had had minimal instruction.

Considering the results of both polygraph tests and interviews, it would thus seem that, although regular atomic energy indoctrination before the maneuver resulted in an increase in the confidence which troops expressed immediately after participation, it did not materially affect troops' emotional reactions to atomic dangers..

DELAYED REACTIONS

After a lapse of time following participation in an A-bomb maneuver, are the attitudes and emotional reactions to A-bomb dangers of minimally indoctrinated troops changed in different amounts or directions than the reactions of regularly indoctrinated troops?

Troops in DESERT ROCK I gave some evidence of a rise in anxiety and apprehension concerning A-bomb dangers following a lapse of time after participation in the maneuver. These troops had received the standard atomic indoctrination before the maneuver. It was hypothesized that troops who received only mini-

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mal instruction before participation in an A-bomb maneuver might later show a greater rise in feelings of anxiety and tension than would regularly indoctrinated troops. Such a regression did not appear in either the minimally or regularly indoctrinated troops studied in DESERT ROCK IV.

The groups of minimally and regularly indoctrinated troops who were given a polygraph test at Desert Rock after participating in the maneuvers were retested 19 days later after their return to home camp. Neither group showed any significant rise in their emotional reactions to the atomic danger questions after this interval of time. Reactions of the regularly indoctrinated group actually decreased, although this change was probably an artificial one resulting from the elevated emotional responses obtained at the time of their first test on D Day. In verbal responses to the polygraph questions concerning atomic dangers, there were no marked changes for either minimally or regularly indoctrinated troops; both groups in fact showed a slight, although probably insignificant, increase in expressed confidence 19 days after their first test. Within this short period of time, therefore, there is no evidence to indicate that troops who participated in the DESERT ROCK IV maneuvers afterward experienced a rise in apprehension, or that troops who had received minimal indoctrination differed in this respect from troops who had received regular indoctrination.

REACTIONS TO ATOMIC VERSUS COMBAT DANGERS

Are the emotional reactions of troops to A-bomb dangers similar in magnitude to their emotional reactions to combat dangers?

In attempting to assess the reactions of troops to atomic dangers, and to estimate the effects of A-bomb maneuvers on such reactions, it was considered desirable to provide a yardstick against which the magnitude of emotional reactions could be gauged. For this reason, questions concerning the dangers of ordinary combat were included in the polygraph test, along with questions pertaining to atomic dangers. It was hoped that, by comparing troops' emotional reactions to these two types of questions, it would be possible to estimate the relative degree to which atomic dangers, as compared with combat dangers, arouse fear in Army troops. Evidence obtained by this method indicated that troops react more strongly to the dangers of ordinary com-

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but than they do to the dangers of the A-bomb. All groups of soldiers tested on the polygraph in DESERT ROCK IV showed greater emotional responses to combat than to A-bomb questions. This was true for participant as well as non-participant troops, for troops both before and after participation in the maneuvers, and for troops receiving mini--l as well as regular A-bomb indoctrination.

EFFECTS ON PERFORMANCE

In the efficiency of troop performance impaired as a result of stress induced by an atomic explosion?

Troops in DESERT ROCK I showed no outward signs of fright and performed their maneuver duties in a routine manner. This was also true of troops participating in the DESERT ROCK IV maneuvers. Additional evidence that the stress of an A-bomb explosion does not impair troop performance was supplied by the performance test results. The small group of men who performed the disassembly and reassembly of the M-1 rifle both before D Day and again immediately after they had witnessed an atomic explosion executed the task rather more quickly in the second test than in the first. Clearly they suffered no impairment of manual dexterity in performing a routine military task.

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INTERPRETATION OF RESULTS

BEHAVIORAL EVIDENCE

Although the results of the studies made by ORO in DESERT ROCK IV are not wholly consistent, certain rather clear-cut patterns emerge. In all shots, and by all methods of study employed, there are no indications that troops are seriously disturbed about the dangers of atomic weapons. On the most overt level, that of performing a task requiring a steady hand and some degree of manual dexterity, there is not the slightest evidence of a decrement in performance by troops who have just witnessed an atomic explosion and will shortly advance into the damage area. This level of behavior is, of course, of great concern to the Army.

VERBAL EVIDENCE

On less overt levels, it is true, some indications of anxiety and apprehension are evident. Before participating in an atomic maneuver, some men admit being afraid of certain aspects of the A-bomb. After undergoing a maneuver experience, fewer men express these fears; but some still are fearful. From both polygraph verbal data and interview responses it was found that troops about to undergo their first A-bomb experience were slightly more fearful than those who had already had such an experience. On the other hand, there is no indication from the verbal data that such fears are sufficiently widespread or severe to cause concern.

PHYSIOLOGICAL EVIDENCE

On a more basic level, that of physiological-emotional reaction, there is little or no evidence that troops are detrimentally anxious or tense about A-bomb dangers. Polygraph tests given at

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all three shots consistently indicate a low level of physiological reaction to the atomic danger questions. Evidence that the reactions of participants did not differ materially from those of non-participants, and that troops reacted the same way when tested before taking part in an atomic maneuver as they did when tested afterwards would seem to indicate that troops are not basically disturbed about A-bomb dangers. Such an interpretation is supported by the physiological reactions of troops to polygraph questions concerning combat dangers. Without exception, all groups of troops tested in the three shots gave larger emotional reactions to the combat questions than to the atomic questions. Apparently their basic fears concerning ordinary combat are greater than their fears of the A-bomb.

DESERT ROCK IV VERSUS DESERT ROCK I FINDINGS

The weight of evidence accumulated by ORO in DESERT ROCK IV tends to minimize the psychological impact of A-bomb dangers on Army troops, at least when the weapon is used in their support or under controlled conditions. These results differ in some respect from those of the first atomic exercise. In DESERT ROCK I, although troops performed adequately, and verbally indicated a high level of confidence in their safety during atomic maneuver operations, they showed, in the polygraph blood pressure measurements, some indication of underlying tension concerning A-bomb dangers. This tension was not evidenced by non-participants tested at their home camp but was marked in participant troops tested before D Day. When these men were retested after the atomic maneuver, however, this tension was found to have been significantly reduced.

One possible explanation for this discrepancy between the physiological findings from the two atomic exercises is that DESERT ROCK I represented the first use of troops in an atomic maneuver and participation was perhaps a more stressful experience than in subsequent exercises. It would seem logical, however, that this greater stress would also result in an increase in verbal expressions of anxiety and fear. This was not the case, however. Whereas troops in DESERT ROCK IV showed less physiological tension regarding A-bomb dangers than did those at DESERT ROCK I but verbally expressed some amount of apprehension, troops at DESERT ROCK I verbally expressed a rather surprising lack of anxiety and concern.

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There is another and perhaps more plausible explanation of the discrepancy between results from the two exercises. The troops in the DESERT ROCK I maneuver, drawn from the 11th Airborne Division, believed they had been selected because they were a "crack outfit"; rumors circulated that the Army had deliberately chosen first-rate troops in order to ensure that the first A-bomb maneuver would be a success. Such factors as nation-wide publicity, the presence of large numbers of official observers, and the knowledge that their behavior and reactions were being studied by ORO and other research organizations undoubtedly helped to make the participating troops well aware of the importance of their role. They might, therefore, be expected to tend to cover up feelings of anxiety and fears concerning their safety in the maneuver. If this was actually the case, it may account for the relatively small amount of verbally expressed apprehension and also for the relatively large physiological responses to questions relating to A-bomb dangers. If troops actually felt somewhat apprehensive, yet answered polygraph questions in such a way as to deny these feelings, heightened physiological reactions might be more a function of emotional disturbance related to the act of deception than of direct emotional disturbance concerning the question-content. On the other hand, in the DESERT ROCK IV maneuvers, troop participation was not confined to "elite" units, the activities of research observers were less extensive, and the use of troops in atomic maneuvers was no longer a novelty and had proved successful. Participants may, therefore, actually have been less fearful and at the same time have been more willing to admit such apprehensions as they did feel.

Such an interpretation, if valid, has certain implications for future research involving the measurement of fear reactions. It may be that in new situations involving personal danger, personnel are likely to "cover up" their real feelings and attitudes, and hence conscious verbal responses may be less indicative of their emotional state than are indices of physiological reactions. If this is the case, greater emphasis should be placed on the measurement of troops' involuntary physiological reactions, and less reliance should be placed on verbal testimony alone.

EVALUATION OF DESERT ROCK MANEUVERS

The major finding of this study of the DESERT ROCK IV maneuvers—that participation apparently had little or no effect upon

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the emotional reactions of the troops to the A-bomb — raises the question of the value of such maneuvers in preparing troops for atomic warfare operations.

The effectiveness of these maneuvers should be weighed against the dollar cost. Before DESERT ROCK IV was carried out, it was estimated that \$466,425.00 would cover the cost of movement of observers and participating troops to Camp Desert Rock and return to home station, the movement of equipment of participating troop units to and from Desert Rock, and technical service requirements at the Camp.* The actual cost of these maneuvers was finally determined to have been \$591,000.00.†

It is generally agreed that some kind of atomic warfare training is essential for Army personnel. According to current Army doctrine, outlined in Training Circular 33, maximum exploitation of the destructive effects of an atomic explosion on the enemy should follow promptly. The Circular points out, however, that "the shock and fear produced by the tremendous blast, the blinding flash, heat, the atomic cloud, and fear of the unknown may produce disorganization in poorly trained and indoctrinated (friendly) individuals or units."‡ It is, therefore, considered highly important that all personnel receive "adequate training in preparation for atomic warfare," and "instruction in the capabilities and limitations of atomic weapons, so that the adverse psychological effects of atomic warfare will be minimized."§

It may be assumed that an important goal of the Desert Rock training maneuvers was to eliminate exaggerated fear of atomic weapons by giving troops first-hand experience with atomic explosions. The present study indicates that troops expressed relatively little fear of the A-bomb and that their emotional reactions were unchanged after participation. These findings suggest: either that the psychological effects of atomic weapons are somewhat overrated and excessive fears of these weapons are not characteristic of Army troops, or that the Desert Rock maneuvers, with their emphasis on safety precautions and the virtual elimination of possible elements of danger, were not realistic enough to evoke fear responses among the participating troops. Whatever the reason, the DESERT ROCK IV maneuvers were apparently

*Schoke report, op. cit., p. 12.

†Information obtained through Training Branch, Organization and Training Division, G-3. This total did not include the costs of Marine participation in Shot 4 of the Exercise.

‡Training Circular 33, Department of Army, Combined Arms Units in Atomic Warfare, 5 Nov 1952, p 18, RESTRICTED.

§Ibid., p 2.

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of little value, if reducing the participants' fears of the A-bomb was one of the primary objectives.

It is not suggested that these maneuvers failed to accomplish other training objectives: troops presumably gained some knowledge of tactical operations involved in the use of atomic weapons; they received training in safety measures; and they were able to see what effects a particular atomic explosion had on certain types of emplacements, materiel, and equipment. A study of the possible gains in knowledge about, and understanding of, atomic explosions, resulting from troop indoctrination at Desert Rock and from the maneuver experience itself, is beyond the scope of the present investigation. It is suggested, however, that effective training in these areas could be achieved by other methods. Training in tactical operations could be provided in regular Army maneuvers in which atomic bursts are simulated. Indoctrination in protective measures, effects of atomic explosions, and so on, might be effectively achieved by means of lectures, demonstrations, and training films. In films, troops could see the effects of bombs of different sizes exploded at different altitudes, whereas the soldier in DESERT ROCK IV participated in but one shot and saw the effects of but one explosion.

A-bomb maneuvers may, of course, provide valuable training and experience for special observers, officers, and enlisted specialists, but large-scale participation of troops is not necessary to provide this type of technical training.

It is recognized that the troop maneuvers at Desert Rock may have other purposes and values than those stated explicitly by the Army. The knowledge that US troops are receiving extensive training in atomic warfare operations, plus the fact that actual A-bombs are being exploded in training maneuvers, may have a significant propaganda effect upon our potential enemies. The psychological effect upon our own civilian population may also be important. The considerable publicity given to the Desert Rock maneuvers may lead to a general recognition of the A-bomb as an accepted weapon of warfare and may create confidence in the Army's ability to handle this weapon. Such confidence on the part of the general public might be important in allaying fears of danger to our troops if atomic weapons are used in future combat operations, whether by US forces or by the enemy. Even more important, Army experience with A-weapons, and public knowledge of this experience, might be a significant factor in reducing panic and disorganization in case of atomic attack by an enemy on US civilian centers, since civilians might be more responsive

to the "know-how" and leadership of officers and have more confidence in the self-discipline of troops. These and other considerations perhaps enter into any decision which the Army may make regarding the continuance of large-scale troop maneuvers at Desert Rock.

If the training of troops in atomic warfare operations is the primary consideration, however, the Army is perhaps not justified in continuing to spend the large amounts of money necessary to conduct large-scale maneuvers at Desert Rock, since the psychological effect on participating troops is negligible and the other maneuver training values for troops may be achieved through more economical training methods. It is, of course, possible that if the maneuvers were more realistic, if some actual danger existed or if troops were led to believe that they might be in danger, the effectiveness of training might be increased, and troops might be given more realistic and adequate preparation for actual atomic warfare operations.

RECOMMENDATIONS

On the basis of this study, the following recommendations are made:

1. That, in the absence of changes in troops' emotional reactions to the A-bomb as a result of participation in atomic maneuvers, the Army determine whether indoctrination, training, and other values achieved by large-scale troop participation in such maneuvers are sufficient to justify their cost.
2. That further studies to assess the performance and psychological reactions of troops in connection with atomic explosions be made only when troops are employed under conditions involving danger, surprise, and fatigue approximating those found in combat, or when atomic weapons are actually used in combat operations.

APPENDIX A
THE POLYGRAPH MEASUREMENTS

CONTENTS

	Page
DESCRIPTION OF METHOD	27
ANALYSIS OF PHYSIOLOGICAL RESPONSES TO QUESTIONS	36
ANALYSIS OF VERBAL RESPONSES TO QUESTIONS	55
ANALYSIS OF FREE ASSOCIATION RESPONSES	68
POLYGRAPH TESTS	70
FIGURES	
A1. Diagram of Polygraph Testing Schedules by Shot	31
A2. Mean Increases in Relative Blood Pressure for Types of Questions, Shot 8	42
A3. Mean Increases in Relative Blood Pressure, by Question, Shot 8	43
A4. Test and Retest Mean Increases in Relative Blood Pressure, by Question, Shot 6	46
A5. Mean Blood Pressure Responses of Participant and Non-participant Troops to A-bomb and Combat Questions, Shot 6	49
A6. Mean Blood Pressure Responses of Regularly and Minimally Indoctrinated Troops to A-bomb and Combat Questions, Shot 6	50
A7. Mean Increases in Relative Blood Pressure, by Question, for Airborne and Regular Infantry Troops, Shot 3	53
A8. Mean Increases in Relative Blood Pressure, by Question, for Troops Tested Before and After Maneuver Participation, Shot 3	54

CONTENTS (Cont.)

	Page
A9. Mean Blood Pressure Responses by Question, for Troops Participating in Shots 3, 6, and 8	55
A10-A15. Verbal Responses Indicating Confidence in Self or Unit, or Lack of Fear in Combat and A-bomb Situations	
A10. Troops Participating in Shots 3, 6, 8	58
A11. Infantry and Airborne Troops, Shot 3	60
A12. Armored Infantry Participants and Non-participants, First Test, Shot 6	61
A13. Armored Infantry Participants and Non-participants, Second Test, Shot 6	62
A14. Regularly and Minimally Indoctrinated Armored Infantry Participants, Shot 6	63
A15. Experienced and Inexperienced Troops, Shot 8	64
A16-A17. Change from Test to Retest, Indicating Confidence in Self or Unit, or Lack of Fear in Combat and A-bomb Situations	
A16. Participant and Non-participant Troops, Shots 3 and 6	66
A17. Regularly and Minimally Indoctrinated Troops, Shot 6	67

TABLES

A1. Polygraph Test, Retest, and Analysis Groups, by Shot	34
A2. Number of Troops, by Background Categories, Test on the Polygraph	35
A3. Summary of Analysis of Variance	37
A4. Mean Increases in Relative Blood Pressure, Shots 6 and 8	44
A5. Analysis of the Blood Pressure Responses of Troops, Shot 6	48
A6. Mean Increases in Relative Blood Pressure, by Test Question, Shot 3	52
A7. Verbal Responses to Polygraph Questions	56

DESCRIPTION OF METHOD

The bulk of the data gathered in the present study consisted of troops' reactions, measured by means of a polygraph instrument, to questions concerning the A-bomb and to other questions pertaining to various aspects of military experience. The polygraph technique was used in an effort to obtain information regarding troops' emotional reactions to the A-bomb which might not be expressed on a verbal level (in interviews and questionnaires) or revealed in overt performance.

The instrument, better known to laymen as a "lie-detector," was a modification of the Keeler type, yielding a continuous record of respiratory and circulatory changes in the subject during a 10 to 15 minute period of questioning. No attempt was made to use the polygraph as a lie detector. The instrument was employed merely as a means of recording troops' involuntary physiological reactions to certain ideational stimuli.

Administration of the Tests

In each of the three shots, the polygraph records were obtained by operators employed by Russell Chatham, Inc. Although the operators had had a great deal of experience in the use of the instrument in security investigations, they were relatively inexperienced in the present type of research investigation. For this reason, the polygraph test was made as simple and standard as possible, questions were presented in the same order, and operators were generally given minimum latitude in conducting the tests.

Polygraph interviews at Camp Desert Rock were conducted in a small wall tent; tests given at home camp were administered in an office or other room affording both privacy and some measure of protection from outside noises and disturbances. At Desert Rock such disturbances were a source of trouble; loudspeaker and other sounds sometimes made it difficult for the subjects to hear the examiners' questions. The influence of extraneous noises on the subject's physiological reactions is an unknown factor.

Each subject was tested individually by the polygraph operator. A standard set of instructions was given to each man regarding the purpose and nature of the test, and the procedure followed by the operator did not vary from subject to subject except where hereinafter specified. The test questions and the order of their presentation were the same for Shot 6 and Shot 8; in Shot 3 a slightly different series of stimuli was used, with a

somewhat different order of presentation. The two series of test items are reproduced at the end of this Appendix.

The Stimuli

The most important test items in both series were questions concerning A-bomb dangers. For comparison purposes, questions dealing with combat dangers were included in both tests, and also a few additional questions which pertained to neither combat nor A-bomb situations. Paratroopers tested in the Shot 3 experiment were also asked certain questions concerning the parachute jump. All questions were so worded that they could be answered by a simple "yes" or "no" to minimize the effect of vocalization on the physiological responses. A second type of item, included in both test series on an exploratory basis, consisted of a single-word stimulus to which the subject was asked to respond with the first word that came to mind. Stimuli included in this word-association section were selected on the basis of their presumed relevancy, or lack of relevancy, to the A-bomb situation.

The non-A-bomb, non-combat questions were included in the test to serve several functions. It was felt that if the test were overloaded with specific atomic energy questions, troops who were tested might suspect they knew they were to participate in the maneuver and might expect that they were to be assigned to Desert Rock, and thus a pre-participation base-line measurement of reactions would not be obtained. Also, these questions were used as the first item in each half of the test, so that the pertinent A-bomb and combat items would not be influenced by any of the exaggerated physiological reactivity which often occurs at the beginning of a series of stimulations. Since these questions were relevant neither to A-bomb nor to combat situations, they have been called "irrelevant" questions throughout this study.

The Polygraph Record

A polygram provides a continuous record of changes in a subject's blood pressure and breathing during the test period. The operator indicated the point at which each stimulus (question or word stimulus) was presented to the subject by making a vertical mark at the base of the chart. The subject's response (either "yes" or "no" to a question, or a word response to a word association stimulus) was also recorded by the operator at the base of the chart, with a mark indicating the point at which it was made. Two types of data, therefore, are available from the

polygraph test: the subject's verbal responses and his physiological reactions to the stimuli. The latter type of data is of primary interest; the verbal responses, however, are also meaningful.

The polygraph used in this study reflected changes in the subject's blood pressure and respiration during questioning, and, from the resulting record, a number of indices of physiological response can be derived. Of these possible measures, only one was selected for treatment in this report: amount of increase in relative blood pressure following presentation of the stimulus, as measured by the amount of deflection of the recording pen from the pre-stimulus level. In the tests, blood pressure changes occurred more frequently than did changes in other indices, and were exhibited in at least some degree by all subjects. Therefore, rise in relative blood pressure was selected for use as being a sensitive measure of physiological reaction to test stimuli.

The Measurement of Relative Blood Pressure Rise

The device for measuring circulatory changes in a Keeler type polygraph is a cuff wrapped snugly around the arm. Changes in the volume of the limb, under the cuff, cause small increases in pressure inside the cuff. These changes are transmitted, through a closed pneumatic circuit, to a writing pen. The deflections of the pen over the moving chart, therefore, become indicative of changes in pressure within the cuff. The numbers used in the analysis of results represent the excursion of the pen, in millimeters, across the chart paper showing increase in "relative blood pressure."

It should be emphasized that these measures do not necessarily correspond to the "millimeters of mercury" which physicians commonly use in expressing the magnitude of absolute blood pressure. The cuff in a Keeler type polygraph does not occlude blood flow. Changes in limb volume under the cuff, which this polygraph does measure, are probably a function of blood pressure, rate of flow, and some unknown factors. It is generally agreed, however, that this mixture of circulation measures, which has come to be known as "change in relative blood pressure," is a fairly well-established indicator of emotional disturbance.

In order to obtain data which would be comparable from subject to subject, it was necessary to measure relative blood pressure rise from a standard point in the stimulus-response sequence. This point was designated as the blood pressure level immediately prior to the beginning of the stimulus presentation, which was recorded on the polygram by a vertical line. Since the

stimuli varied in length, and the subjects differed in their physiological reaction time, the second point of measurement could not be held constant. Therefore, measurement was made at the point of highest blood pressure level occurring after the presentation of the stimulus and before the presentation of the next stimulus. (The usual interval proved to be approximately 15 seconds.)

The amount of relative blood pressure rise following each stimulus was measured on each subject's polygram, and recorded on the subject's data card. The subject's verbal responses to the stimuli were also entered on the card, which contained information concerning the date, time, and place of testing, the subject's name or identification number, the subject's rank, race, and unit designation. Not all of this information was available for every subject tested in the three shots. In Shots 3 and 8, subjects were identified by name and unit. In Shot 6, however, subjects were anonymous, and only a special identification number was recorded on the polygram. This number made it possible to match separate tests on the same individual, but prevented the identification of any subject by name.

Subjects Tested on the Polygraph

Since the type of troops, time and place of testing, and so forth, varied from shot to shot, the sample for each shot will be described separately. A diagram of the polygraph testing schedule is shown in Fig. A1.

Shot 3. Two types of troops, regular infantry and airborne infantry, were tested both before and after the maneuver at Camp Desert Rock, in order to ascertain the effect of participation in the exercise on the responses of different types of troops. Tests were administered on the three days preceding the maneuver. Retests were administered on D Day after the maneuver was completed, and on the following day.

The regular infantry troops were drawn from participating units of the 135th Infantry Regiment, 47th Infantry Division. Forty-two enlisted men, selected on a random basis from their unit rosters, were tested before the maneuver. After the maneuver, 20 men selected at random from the original group of 42 were retested.

Forty-two enlisted men selected at random from the two participating companies of the 504th Airborne Infantry Regiment, 82d Airborne Division, were tested before the maneuver. This sample was broken down into two groups of 21 men each, from F Company, which was scheduled to

Let's give a hand out to all other's place at Desert Rock.

Fig. A1—Diagram of Polygraph Testing Schedules by Shot

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make a parachute jump after the burst, and from H Company, which was not. After the maneuver 20 men, 10 each from F Company and H Company, selected at random from the original test groups of 21, were retested. In the case of F Company, three of the sample of ten were not available for retesting (because of jump injuries or emergency leave) and three replacements were made from the original group.

The remainder of the men from both the 135th Infantry Regiment and the 504th AIR were to be retested at a later date, in their home camps, in order to investigate possible changes in reactions after a lapse of time. A follow-up of these troops showed that so many of the men had been discharged or transferred, however, that a second testing was not possible.

Shot 6. All troops tested in Shot 6 were drawn from the 1st Armored Division, stationed at Ft Hood, Texas. Two major types of subjects were tested: men who participated in the DESERT ROCK IV maneuver, and men who neither participated in the maneuver nor went to Camp Desert Rock.

In this shot, ORO's study was carried out in conjunction with an investigation conducted by the Human Resources Research Office (HumRRO). The latter organization made extensive use of information and attitude questionnaires and a projective test, and used several other techniques, such as a palmar sweat measure, on a more limited scale. ORO concentrated on the measurement of physiological reactions of troops, using the polygraph test, and also conducted interviews with participant troops.

Three participant groups (P-1, P-2R, and P-3M) and two non-participant groups (N-1 and N-2) were used by ORO in the polygraph tests.

Data obtained from tests of participant Group P-1 (40 men) were compared with those obtained from non-participant Group N-1 (40 men). Group P-1 was tested at Ft Hood, their home station, on D minus 11, before the announcement of which troops would participate in the Desert Rock maneuver. The next day, control Group N-1 was tested, also at Ft Hood. Group P-1 was retested 13 days later, on D plus 2, after they had moved to Camp Desert Rock, been exposed to full indoctrination, and gone through the maneuver. Group N-1 was retested six days after its first test, on D minus 4; they had not gone to Camp Desert Rock or had any of the other experiences which participant Group

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P-1 had undergone. Control Group N-2 (31 men) was tested for the first time on D minus 3 and retested on D plus 12, both tests being given at the home station.

The other two participant groups, Group P-2R (39 men) and Group P-3M (39 men) were tested for the first time after the maneuver at Desert Rock, on D Day, and the day after. They differed from each other in that Group P-2R had received the regular atomic indoctrination given at Desert Rock before D Day, while Group P-3M was given only a minimal amount of indoctrination—the short safety indoctrination at the forward area on rehearsal day. Data obtained from these two groups were compared. Groups P-2R and P-3M (reduced to 35 and 32 subjects respectively) were both given their second tests at home camp 19 days after their first tests, in order to measure the effects on responses of a lapse of time after the maneuver.

Men were originally assigned to experimental and control groups by HumRRO representatives on a systematic random basis;* subsamples chosen by ORO for polygraphing were selected from these major groups on a random basis.†
Shot 8. All troops tested on this shot were station complement personnel. Two types of subjects were chosen for study: men who had witnessed previous shots and participated in previous maneuvers, and men who were scheduled to take part in a maneuver for the first time. Since there were relatively few men in this latter category, this inexperienced sample was selected first. Forty men were chosen on the basis of unit records indicating participation or non-participation in previous maneuvers. From the larger group of experienced men, 40 subjects were selected to match the inexperienced subjects in rank, race, and

*Two of the experimental groups consisted of D Company troops only (men given a minimal amount of atomic energy indoctrination at Desert Rock). There was no evidence that D Company troops differed systematically from troops in other companies, and it was assumed that any significant test differences found between minimally and regularly indoctrinated troops would be a function of differences in the indoctrination they received.

†The original matched design called for polygraphing by ORO of four participant and four non-participant groups. Eight each group, of 100 or more men each, were selected for testing by ORO, and 50 or 40 men from each group were scheduled to be given polygraph tests. Because of changes in the date of the tests, and the inability of testing personnel to complete testings in the time allowed by changes in date of tests, the groups finally tested were reduced to three participant groups and one non-participant group.

Participant Group P-1 was originally scheduled for entry on D minus 1, so that effects of movement to Desert Rock and exposure to indoctrination could be measured. Because the polygraph operators were unable to get to Desert Rock in time to test this group before D Day, the test was postponed until D plus 2. As a result, the effects of movement to Desert Rock and exposure to indoctrination could not be separated from the effects of participation in the maneuver.

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Military Occupational Specialty. Both groups were given the polygraph test on D minus 1 and D minus 2.

Discarded Subjects

After measurements of relative blood pressure reactions to each stimulus had been made for all of the men tested on the polygraph, the data were examined and certain records discarded. Faulty records, distortion of the pressure records because of the subject's muscular movement, omission or repetition of any questions by the operator, and equipment failure made such discards necessary. In addition, records on some subjects in Shots 3 and 6 were discarded because of a failure to take retests, and a number of records obtained in Shot 8 were dropped because of conflicting information concerning the subject's participation or lack of participation in previous A-bomb maneuvers. The number of subjects in the test, retest, and final analysis groups for each shot is shown in Table A1.

TABLE A1

POLYGRAPH TEST, RETEST, AND ANALYSIS GROUPS, BY SHOT

Shot	Group	Test, No.	Retest, No.	Final, No.
3	Air	42	20	19 ^a
	Infantry	42	20	20 ^a
6	P-1	49	35	27
	P-2M	39	35	23
	P-3M	39	32	26
	N-1	40	40	27
	N-2	31	31	23
8	A-bomb Exp.	40	(No	21
	A-bomb Inexp.	40	retest)	30

^aSince the Shot 3 data were not subjected to extensive statistical treatment, subjects with incomplete records were not discarded from the final analysis group.

Identifying Information

Before each polygraph test in all shots the subject completed an information sheet. This provided data concerning the subject's age, rank, method of entry into the Army, and combat experience.

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TABLE A2
NUMBER OF TROOPS, BY BACKGROUND CATEGORIES, TEST ON THE POLYGRAPH

BACKGROUND	SHOT 3				SHOT 6						SHOT 8			
	Inf. (N=20)	Air (N=19)	Total		Participant Groups				Non-Participant Groups		Total (N=126)	A-bomb Expos. (N=21)	A-bomb Innocent (N=30)	Total (N=51)
			%	N	P-1 (N=27)	P-2R (N=23)	P-3M (N=26)	N-1 (N=27)	N-2 (N=23)					
Army Component Regiment: Army National Guard Drafted Reserve (n)	2 5 -- -- 13	19 0 0 0 --	21 5 -- -- 33	54 13 -- -- 33	9 0 18 0 --	7 0 16 0 --	5 0 20 1 --	12 0 14 1 --	12 0 11 0 --	9 0 11 1 --	24 0 6 0 --	33 0 17 1 --	65 0 33 2 --	
Rank Private Corporal Sergeant	6 0 0 0	10 3 6 6	16 11 12 31	41 28 31 --	10 9 0 0	10 0 3 3	14 2 4 4	0 9 10 11	10 9 11 11	13 7 1 1	11 15 4 --	24 23 5 --	47 43 30 --	
Race White Negro	20 0	19 0	29 0	100 0	21 6	22 1	21 5	23 4	18 5	15 6	17 13	32 19	49 37	
Combat History Combat experience No combat experience	1 19 --	2 17 --	3 26 --	8 92 --	13 12 29	0 15 30	10 14 29	13 14 22	13 10 29	9 12 22	21 9 23	30 21 23	59 41 --	
Median Age ^b	--	--	--	--	29	30	29	22	29	22	23	23	--	

^aNo separation of draftees and reserves was possible for the Shot 3 subjects.

^bSubjects were not asked to give birthdate on the Shot 3 information blanks.

Racial composition of the various groups tested on the polygraph is also known, as the race of each subject was recorded by the polygraph operator on the polygram. The number and percent of subjects according to these background variables are shown for each test group for each shot in Table A2.

Varying Reliability of the Data

The nature of the data varied somewhat from burst to burst. As has been indicated earlier, a somewhat different question series was used in Shot 3. In this shot, the operators were less experienced in polygraph operation for research purposes, and deviated from the standard procedure. They sometimes changed the order of questions, and often repeated one or more questions in the course of a test. Also, the polygraph apparatus gave some difficulty, and the records show some indication that pressure changes in some subjects may have been somewhat reduced in magnitude as a result of malfunctioning of the equipment. For this reason, the blood pressure data for Shot 3 were not considered reliable enough to warrant detailed statistical treatment.

ANALYSIS OF PHYSIOLOGICAL RESPONSES TO QUESTIONS

The physiological response data from the polygraph test were analyzed separately by shot. The results from Shot 8 are discussed first, since the statistical processes used in the analysis are worked out in more detail, and serve as a model for the statistical processes used in the analysis of Shot 6 data.* Because the Shot 3 records were incomplete and considered relatively unreliable, these data were not analyzed extensively, and only brief findings are presented.

Shot 8 Findings

The two populations utilized in Shot 8 afford a unique kind of comparison between the blood pressure responses of experienced troops (those who have been through previous A-bomb experiences) and those of troops who have never before had such experience. In both cases the troops were tested at Camp Desert Rock before D Day, so that their blood pressure responses may tend to reflect their emotional reactions to the impending event. This comparison was used to answer, in part, the question "Are troops' emotional

*A detailed description of the analysis of variance technique used in these analyses is available upon request from Project SHOP, Operations Research Office.

TESTS

TABLE A3
SUMMARY OF ANALYSIS OF VARIANCE
PART 2. ANALYSIS OF QUESTIONS

Source of Variation	Interpreting Main (B = 20)			Experimenting Main (B = 21)			Analyzing of Difference		
	Sum of Squares	df	Mean Square	Sum of Squares	df	Mean Square	Sum of Squares	df	Mean Square
Between Subjects	64.200	1	64.200	64.200	1	64.200	64.200	1	64.200
Within Subjects	88.800	19	4.674	17.600	19	0.926	17.600	19	0.926
Total	153.000	20		81.800	20		81.800	20	
Between Groups	64.200	1	64.200	64.200	1	64.200	64.200	1	64.200
Within Groups	88.800	19	4.674	17.600	19	0.926	17.600	19	0.926
Total	153.000	20		81.800	20		81.800	20	
Between Subjects	64.200	1	64.200	64.200	1	64.200	64.200	1	64.200
Within Subjects	88.800	19	4.674	17.600	19	0.926	17.600	19	0.926
Total	153.000	20		81.800	20		81.800	20	
Between Groups	64.200	1	64.200	64.200	1	64.200	64.200	1	64.200
Within Groups	88.800	19	4.674	17.600	19	0.926	17.600	19	0.926
Total	153.000	20		81.800	20		81.800	20	
Between Subjects	64.200	1	64.200	64.200	1	64.200	64.200	1	64.200
Within Subjects	88.800	19	4.674	17.600	19	0.926	17.600	19	0.926
Total	153.000	20		81.800	20		81.800	20	
Between Groups	64.200	1	64.200	64.200	1	64.200	64.200	1	64.200
Within Groups	88.800	19	4.674	17.600	19	0.926	17.600	19	0.926
Total	153.000	20		81.800	20		81.800	20	
Between Subjects	64.200	1	64.200	64.200	1	64.200	64.200	1	64.200
Within Subjects	88.800	19	4.674	17.600	19	0.926	17.600	19	0.926
Total	153.000	20		81.800	20		81.800	20	
Between Groups	64.200	1	64.200	64.200	1	64.200	64.200	1	64.200
Within Groups	88.800	19	4.674	17.600	19	0.926	17.600	19	0.926
Total	153.000	20		81.800	20		81.800	20	
Between Subjects	64.200	1	64.200	64.200	1	64.200	64.200	1	64.200
Within Subjects	88.800	19	4.674	17.600	19	0.926	17.600	19	0.926
Total	153.000	20		81.800	20		81.800	20	
Between Groups	64.200	1	64.200	64.200	1	64.200	64.200	1	64.200
Within Groups	88.800	19	4.674	17.600	19	0.926	17.600	19	0.926
Total	153.000	20		81.800	20		81.800	20	
Between Subjects	64.200	1	64.200	64.200	1	64.200	64.200	1	64.200
Within Subjects	88.800	19	4.674	17.600	19	0.926	17.600	19	0.926
Total	153.000	20		81.800	20		81.800	20	
Between Groups	64.200	1	64.200	64.200	1	64.200	64.200	1	64.200
Within Groups	88.800	19	4.674	17.600	19	0.926	17.600	19	0.926
Total	153.000	20		81.800	20		81.800	20	
Between Subjects	64.200	1	64.200	64.200	1	64.200	64.200	1	64.200
Within Subjects	88.800	19	4.674	17.600	19	0.926	17.600	19	0.926
Total	153.000	20		81.800	20		81.800	20	
Between Groups	64.200	1	64.200	64.200	1	64.200	64.200	1	64.200
Within Groups	88.800	19	4.674	17.600	19	0.926	17.600	19	0.926
Total	153.000	20		81.800	20		81.800	20	
Between Subjects	64.200	1	64.200	64.200	1	64.200	64.200	1	64.200
Within Subjects	88.800	19	4.674	17.600	19	0.926	17.600	19	0.926
Total	153.000	20		81.800	20		81.800	20	
Between Groups	64.200	1	64.200	64.200	1	64.200	64.200	1	64.200
Within Groups	88.800	19	4.674	17.600	19	0.926	17.600	19	0.926
Total	153.000	20		81.800	20		81.800	20	
Between Subjects	64.200	1	64.200	64.200	1	64.200	64.200	1	64.200
Within Subjects	88.800	19	4.674	17.600	19	0.926	17.600	19	0.926
Total	153.000	20		81.800	20		81.800	20	
Between Groups	64.200	1	64.200	64.200	1	64.200	64.200	1	64.200
Within Groups	88.800	19	4.674	17.600	19	0.926	17.600	19	0.926
Total	153.000	20		81.800	20		81.800	20	
Between Subjects	64.200	1	64.200	64.200	1	64.200	64.200	1	64.200
Within Subjects	88.800	19	4.674	17.600	19	0.926	17.600	19	0.926
Total	153.000	20		81.800	20		81.800	20	
Between Groups	64.200	1	64.200	64.200	1	64.200	64.200	1	64.200
Within Groups	88.800	19	4.674	17.600	19	0.926	17.600	19	0.926
Total	153.000	20		81.800	20		81.800	20	
Between Subjects	64.200	1	64.200	64.200	1	64.200	64.200	1	64.200
Within Subjects	88.800	19	4.674	17.600	19	0.926	17.600	19	0.926
Total	153.000	20		81.800	20		81.800	20	
Between Groups	64.200	1	64.200	64.200	1	64.200	64.200	1	64.200
Within Groups	88.800	19	4.674	17.600	19	0.926	17.600	19	0.926
Total	153.000	20		81.800	20		81.800	20	
Between Subjects	64.200	1	64.200	64.200	1	64.200	64.200	1	64.200
Within Subjects	88.800	19	4.674	17.600	19	0.926	17.600	19	0.926
Total	153.000	20		81.800	20		81.800	20	
Between Groups	64.200	1	64.200	64.200	1	64.200	64.200	1	64.200
Within Groups	88.800	19	4.674	17.600	19	0.926	17.600	19	0.926
Total	153.000	20		81.800	20		81.800	20	
Between Subjects	64.200	1	64.200	64.200	1	64.200	64.200	1	64.200
Within Subjects	88.800	19	4.674	17.600	19	0.926	17.600	19	0.926
Total	153.000	20		81.800	20		81.800	20	
Between Groups	64.200	1	64.200	64.200	1	64.200	64.200	1	64.200
Within Groups	88.800	19	4.674	17.600	19	0.926	17.600	19	0.926
Total	153.000	20		81.800	20		81.800	20	
Between Subjects	64.200	1	64.200	64.200	1	64.200	64.200	1	64.200
Within Subjects	88.800	19	4.674	17.600	19	0.926	17.600	19	0.926
Total	153.000	20		81.800	20		81.800	20	
Between Groups	64.200	1	64.200	64.200	1	64.200	64.200	1	64.200
Within Groups	88.800	19	4.674	17.600	19	0.926	17.600	19	0.926
Total	153.000	20		81.800	20		81.800	20	
Between Subjects	64.200	1	64.200	64.200	1	64.200	64.200	1	64.200
Within Subjects	88.800	19	4.674	17.600	19	0.926	17.600	19	0.926
Total	153.000	20		81.800	20		81.800	20	
Between Groups	64.200	1	64.200	64.200	1	64.200	64.200	1	64.200
Within Groups	88.800	19	4.674	17.600	19	0.926	17.600	19	0.926
Total	153.000	20		81.800	20		81.800	20	
Between Subjects	64.200	1	64.200	64.200	1	64.200	64.200	1	64.200
Within Subjects	88.800	19	4.674	17.600	19	0.926	17.600	19	0.926
Total	153.000	20		81.800	20		81.800	20	
Between Groups	64.200	1	64.200	64.200	1	64.200	64.200	1	64.200
Within Groups	88.800	19	4.674	17.600	19	0.926	17.600	19	0.926
Total	153.000	20		81.800	20		81.800	20	
Between Subjects	64.200	1	64.200	64.200	1	64.200	64.200	1	64.200
Within Subjects	88.800	19	4.674	17.600	19	0.926	17.600	19	0.926
Total	153.000	20		81.800	20		81.800	20	
Between Groups	64.200	1	64.200	64.200	1	64.200	64.200	1	64.200
Within Groups	88.800	19	4.674	17.600	19	0.926	17.600	19	0.926
Total	153.000	20		81.800	20		81.800	20	
Between Subjects	64.200	1	64.200	64.200	1	64.200	64.200	1	64.200
Within Subjects	88.800	19	4.674	17.600	19	0.926	17.600	19	0.926
Total	153.000	20		81.800	20		81.800	20	
Between Groups	64.200	1	64.200	64.200	1	64.200	64.200	1	64.200
Within Groups	88.800	19	4.674	17.600	19	0.926	17.600	19	0.926
Total	153.000	20		81.800	20		81.800	20	
Between Subjects	64.200	1	64.200	64.200	1	64.200	64.200	1	64.200
Within Subjects	88.800	19	4.674	17.600	19	0.926	17.600	19	0.926
Total	153.000	20		81.800	20		81.800	20	
Between Groups	64.200	1	64.200	64.200	1	64.200	64.200	1	64.200
Within Groups	88.800	19	4.674	17.600	19	0.926	17.600	19	0.926
Total	153.000	20		81.800	20		81.800	20	
Between Subjects	64.200	1	64.200	64.200	1	64.200	64.200	1	64.200
Within Subjects	88.800	19	4.674	17.600	19	0.926	17.600	19	0.926
Total	153.000	20		81.800	20		81.800	20	
Between Groups	64.200	1	64.200	64.200	1	64.200	64.200	1	64.200
Within Groups	88.800	19	4.674	17.600	19	0.926	17.600	19	0.926
Total	153.000	20		81.800	20		81.800	20	
Between Subjects	64.200	1	64.200	64.200	1	64.200	64.200	1	64.200
Within Subjects	88.800	19	4.674	17.600	19	0.926	17.600	19	0.926
Total	153.000	20		81.800	20		81.800	20	
Between Groups	64.200	1	64.200	64.200	1	64.200	64.200	1	64.200
Within Groups	88.800	19	4.674	17.600	19	0.926	17.600	19	0.926
Total	153.000	20		81.800	20		81.800	20	
Between Subjects	64.200	1	64.200	64.200	1	64.200	64.200	1	64.200
Within Subjects	88.800	19	4.674	17.600	19	0.926	17.600	19	0.926
Total	153.000	20		81.800	20		81.800	20	
Between Groups	64.200	1	64.200	64.200	1	64.200	64.200	1	64.200
Within Groups	88.800	19	4.674	17.600	19	0.926	17.600	19	0.926
Total	153.000	20		81.800	20		81.800	20	
Between Subjects	64.200	1	64.200	64.200	1	64.200	64.200	1	64.200
Within Subjects	88.800	19	4.674	17.600	19	0.926	17.600	19	0.926
Total	153.000	20		81.800	20		81.800	20	
Between Groups	64.200	1	64.200	64.200	1	64.200	64.200	1	64.200
Within Groups	88.800	19	4.674	17.600	19	0.926	17.600	19	0.926
Total	153.000	20		81.800	20		81.800	20	
Between Subjects	64.								

SECRET

TABLE A8 (Cont.)
PART B: ANALYSIS OF ERROR TERM

Source of Variance (x Mean)	Empirical Mean (N = 30)			Expected Mean (N = 31)		
	Sum of Squares	df	Mean Square	Sum of Squares	df	Mean Square
Arms and Combat Questions						
All arms-questions minus all combat questions	250.983	29	8.655	217.300	29	7.493
First arms-questions minus other arms questions	256.594	29	8.848	75.772	29	2.613
Other arms questions comparisons	1303.853	291	4.481	685.097	130	5.269
Questions 5, 6, 8, 15, 16, 19 minus 7, 9, 14, 17	129.06	29	4.450	133.19	29	4.593
Questions 15 minus 7, 9, 17	114.56	29	3.950	96.60	29	3.331
Questions 9 minus 7 and 17	114.56	29	3.950	73.43	29	2.532
Questions 7 minus 17	103.45	29	3.567	47.80	29	1.648
Questions 5, 6, 8, minus 15, 16, 19	135.48	29	4.672	47.80	29	1.648
Questions 8 and 15 minus 9 and 16	100.17	29	3.454	53.81	29	1.856
Questions 6 and 19 minus 5, 8, 15, and 16	140.99	29	4.862	118.69	29	4.093
Questions 5 and 19 minus 8 and 16	130.37	29	4.513	43.37	29	1.496
Questions 5, 6 and 19 minus 8, 15 and 16	136.30	29	4.700	75.06	29	2.588
Least combat questions 15 and 16 minus other combat questions	339.377	29	11.699	186.149	29	6.419
Other combat question comparisons	261.75	27	9.700	275.714	50	5.514
Questions 3 minus 14	146.48	29	5.051	54.90	29	1.893
Questions 13 minus 15	253.49	29	8.741	110.39	29	3.807
Questions 2 minus 15 and 19	150.70	29	5.200	107.53	29	3.708
Error: Men x Questions	2070.506	436	4.749	1254.000	300	4.180
Insulation Questions						
Questions 10 and 20 minus 1 and 11	646.56	29	22.295	595.81	29	20.545
Questions 1 minus 11	151.30	29	5.217	222.57	29	7.675
Questions 10 minus 20	159.80	29	5.510	112.63	29	3.884
Total	639.458	87	7.350	681.00	60	11.350

reactions to, and attitudes toward, atomic dangers changed as a result of participation in an atomic maneuver? The comparison indicates that previous experience in A-bomb maneuvers does not seem significantly to affect troops' emotional reactions to another such experience. This is demonstrated in the following analysis of general responsiveness as a function of experience.

General Responsiveness as a Function of Experience. Since relative changes in blood pressure to any stimuli may indicate the relative stability of the autonomic nervous system, it is useful to ascertain first of all, whether any differences in over-all responsiveness exist between the two groups. It might be expected that the group which was more apprehensive or "jittery" would respond, regardless of the type of question used, with greater blood pressure increases than the group which was less emotionally disturbed about the impending experience. For this comparison, the blood pressure responses of the experienced troops to all combat and A-bomb questions were compared with the blood pressure responses of inexperienced troops to these questions. The responses to the four irrelevant questions are not included, since the analysis of variance showed that these tend to involve a great deal of variability, and cannot justifiably be included along with combat and A-bomb questions.

The mean relative blood pressure increase of the 30 inexperienced troops to the 16 combat and A-bomb questions was 4.14 mm, while the increase of the 21 experienced troops was 3.33 mm, a difference of .81 mm (see Table A3). The critical ratio of this difference is 1.99, which is not statistically significant.*

In the present study, then, the troops did not differ significantly in the magnitude of their autonomic responses as a function of whether or not they had had previous A-bomb experiences. If previous A-bomb experience tends to allay apprehension or jitteriness about further participation in A-bomb maneuvers, it does not do so to an extent which can be measured by this kind of instrumentation. More refined polygraphs, utilizing indicators other than relative blood pressure, are available, and it is possible that some of these measures might show significant differences in general stability of the autonomic nervous system as a function of previous experience in A-bomb maneuvers.

*Statistical significance in this report refers to significance at the 2 percent level of confidence or better.

Within the limitations imposed by the measure used, however, previous experience in A-bomb maneuvers does not seem significantly to decrease emotional reactions to another such experience.

Individual Differences. When data on these troops are further analyzed, it becomes clear that individuals differ significantly from one another in their blood pressure responses to the questions and that this is true for both experienced and inexperienced men. (See Table A3.) This finding reflects the individual differences in the general reactivity of the nervous system of troops as well as their individual differences in attitudes toward the maneuver. In terms of military usefulness, it indicates that individual soldiers may be expected to differ in their emotional reactions to atomic dangers; some tend to be more apprehensive and fearful than others.

Response to A-bomb and Combat Stimuli. Both the inexperienced and the experienced troops gave significantly larger blood pressure responses to combat questions than to those questions related to the A-bomb. (See Tables A3 and A4, and Fig. A2.) Apparently, on the basis of the physiological-emotional response of troops to questions, combat is the more intense stress. The A-bomb does not overshadow their emotional reactions to combat.

The inexperienced troops showed greater differences between combat and A-bomb questions than did the experienced troops. (Table A3 and Fig. A3.) While the mean responses of the two groups to the A-bomb items remained roughly the same, the inexperienced troops showed a heightened response to combat-type questions.

Response to Individual A-bomb Stimuli. The only significant difference which seems to exist among the A-bomb questions is that the troops responded more markedly to the first question on this subject, Number 4, "Do you think the experts know enough to use A-bombs in maneuvers without danger to our troops?" than they did to the other A-bomb questions. Since this was true of both the experienced and inexperienced troops, this difference is apparently not a function of previous A-bomb experience. It may be that one of the really disturbing questions which troops have about the A-bomb involves the competence of experts to use it. One observer at the DESERT ROCK IV maneuver

in which Marines participated (Shot 4) noted, "The only point before the drop at which anxiety was felt by the observer and seemed to be felt by the troops was at the point at which emergency procedures were announced over the loudspeaker. It made the troops aware, almost for the first time, that something could go wrong."²

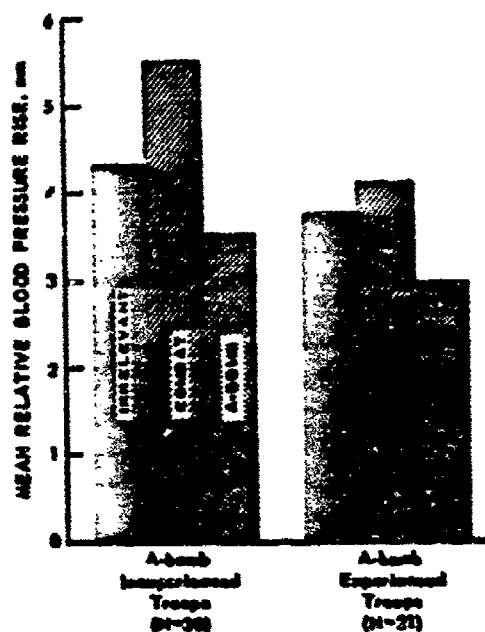


Fig. A2—Mean Increases in Relative Blood Pressure for Types of Questions, Shot 8

It is not certain, however, whether this elevated blood pressure response to the question concerning the competence of experts to use the A-bomb is a function of the question content, or of the fact that it was the first in the series which dealt with the A-bomb. Stimuli were presented in the same order,[†] so that this item always appeared as the fourth question and the first concerning the A-bomb. The troops may have been responding to the first use of the

²Courtesy, D. Adjustment of Troops to Atomic Explosions. Technical report, section 1952, No. 7, Institute for Research in Human Relations, **RESTRICTED**.

[†]The questions were not presented in random order since there was some feeling that it would be too complicated for the polygraph operators, who were not skilled researchers, to follow random order techniques under field conditions.

word "A-bomb" in a question rather than to the whole question.

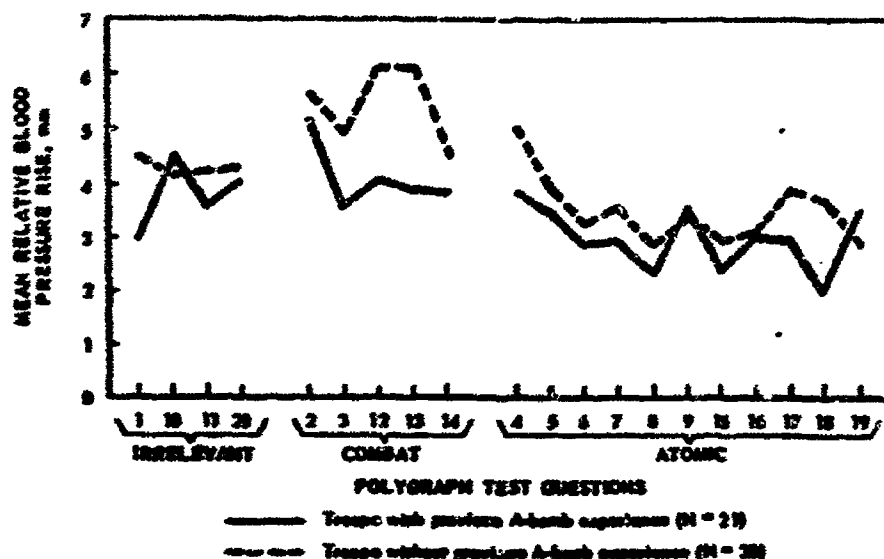


Fig. A2—Mean Increases in Relative Blood Pressure, by Question, Shot 8

Shot 6 Findings

In Shot 6, blood pressure responses to the same 20 questions (A-bomb, combat, and irrelevant) were recorded for 126 men who varied as to participation or non-participation in the exercise, and in amount of indoctrination received prior to the maneuver. This part of the study was designed to answer, in part, the following questions:

1. Are troops' emotional reactions to, and attitudes toward, atomic dangers changed as a result of participation in an atomic maneuver?
2. Following participation in an A-bomb maneuver, do troops who received a minimal amount of A-bomb indoctrination show different emotional reactions to, and attitudes toward, atomic dangers than troops who received full indoctrination?

The answer to the first question was found to be "No"—troops' emotional reactions to atomic dangers do not seem to be changed as a result of participation in an atomic maneuver. The answer to the second question was not so clear. Immediately after the maneuver, the indoctrinated group appears to have evidenced greater emotional response to A-bomb questions than

TABLE A4
MEAN INCREASES IN RELATIVE BLOOD PRESSURE, MM
(SHOTS 6 AND 8)

Question Type ^a	SHOT 6																			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
	I	C	C	C	A	A	A	A	A	I	I	C	C	C	A	A	A	A	A	I
Group	4.07	4.59	3.70	4.74	3.75	2.85	3.00	2.78	2.89	3.93	3.95	6.25	3.93	2.82	3.00	2.42	2.74	2.26	3.96	3.39
P-1 Test	4.23	4.53	3.15	3.80	2.59	2.37	3.11	1.85	3.22	3.22	3.37	4.04	4.07	2.74	2.96	2.19	2.56	2.59	2.33	3.00
Retest																				
P-2M Test	3.83	5.23	4.57	6.65	4.70	4.81	3.87	3.09	2.65	5.30	3.12	5.11	4.91	4.78	4.13	4.00	3.65	3.22	3.87	1.65
Retest	4.68	5.22	4.96	3.91	3.78	2.96	3.17	2.70	3.91	4.69	3.09	6.01	5.78	3.30	3.39	3.26	3.87	2.96	3.44	3.52
P-2M Test	3.45	4.92	4.27	3.96	2.23	2.77	3.35	2.35	2.69	4.81	4.46	4.54	3.62	4.35	2.77	2.42	3.62	2.58	2.73	4.27
Retest	3.45	5.12	4.92	4.42	2.69	2.15	2.55	2.19	2.81	4.84	3.58	3.08	4.31	4.08	3.23	2.42	3.23	3.62	3.15	2.58
Average	3.85	4.98	4.23	4.11	3.43	3.13	3.35	3.44	3.17	4.30	3.45	5.27	4.38	3.63	3.22	2.99	2.25	2.86	3.32	3.43
M-1 Test	2.41	3.11	3.70	3.30	2.93	2.48	3.56	2.55	2.70	3.33	2.59	4.89	3.78	3.63	3.41	3.00	3.07	2.82	3.22	4.27
Retest	2.95	3.74	3.95	2.70	2.67	2.97	3.89	2.81	2.74	3.15	3.15	4.15	2.48	2.56	3.22	2.63	2.82	3.04	3.78	4.07
M-2 Test	4.57	4.48	3.74	4.09	2.91	2.44	3.57	3.09	2.83	4.18	4.00	5.39	4.57	3.57	3.35	2.70	3.26	2.48	2.83	3.65
Retest	4.44	4.93	3.09	4.59	3.17	3.48	3.84	1.78	3.61	4.44	4.44	4.57	4.44	2.87	2.87	3.04	3.39	2.17	2.22	3.78
Average	3.69	4.56	3.62	3.54	2.92	2.69	3.52	2.86	2.73	3.76	3.54	4.75	3.80	3.16	3.21	2.84	3.14	2.63	3.07	3.93
Average, all groups	3.73	4.77	3.92	3.82	3.18	2.91	3.43	2.60	2.94	3.98	3.50	4.96	4.09	3.40	3.22	2.92	3.20	2.74	3.16	3.68
	SHOT 8																			
A-bomb Exp.	2.95	5.19	3.57	3.86	3.43	2.86	2.95	2.33	3.37	4.57	3.52	4.85	3.90	3.51	2.38	3.00	2.95	2.00	3.47	4.10
A-bomb Incap.	4.57	5.70	4.97	5.07	3.93	3.23	3.60	3.83	3.40	4.13	4.23	6.13	6.17	4.60	3.93	3.10	3.97	3.70	4.83	4.30
Average	3.99	5.49	4.39	4.57	3.73	3.06	3.33	2.63	3.47	4.31	3.94	5.27	5.24	4.27	2.71	2.86	3.55	3.00	3.10	4.22

^aIrrelevant question, Overheat question, Atonic question.

did the minimally indoctrinated group, but this may have been the result of fatigue and the recency of the burst experience, since the indoctrinated group was tested on D Day.

Each man was tested twice so that a grand usable total of 5,040 responses was obtained. These data were treated by an analysis of variance technique similar to that used in analyzing the data from Shot 8. The analysis was, however, restricted to a single comparison, the difference between responses to A-bomb and combat questions.

Design of Shot 6 Study. In order to analyze the effect of participation in the maneuver on the physiological-emotional responses of the troops, participant Group P-1 was tested before the maneuver at the home camp and was then re-tested at Camp Desert Rock after the burst. A control group, Group N-1, was tested at approximately the same times, at the home base. It was assumed that any differences between the responses of these groups might be a function of participation in the Desert Rock maneuver.

For the investigation of the effects of intensive indoctrination at Desert Rock on the emotional-physiological reactions of troops, Groups P-2R and P-3M, both participant groups, were used. Group P-2R was tested for the first time at Camp Desert Rock and was retested on 13 June (D plus 19). This group had received the full indoctrination course. Group P-3M was tested one day after group P-2R in each case. This group had received only cursory indoctrination. It was assumed that any differences between the responses of these groups might be a function of receiving or failing to receive full indoctrination.

Response to Combat and A-bomb Stimuli. Table A5 summarizes the findings with respect to the comparison of A-bomb and combat type questions for all of the 126 men. As it demonstrates, the mean blood pressure response to combat questions was higher than the mean response to A-bomb questions in every case. These differences are significant at the 1 percent level of confidence in each instance except the second test for Group N-1. The blood pressure responses of the Shot 6 subjects to each question on both test and retest are shown in Table A4 and in Fig. A4.

As was the case in Shot 8, then, combat type questions appear to have called forth larger blood pressure responses than A-bomb questions. This was true whether or not troops

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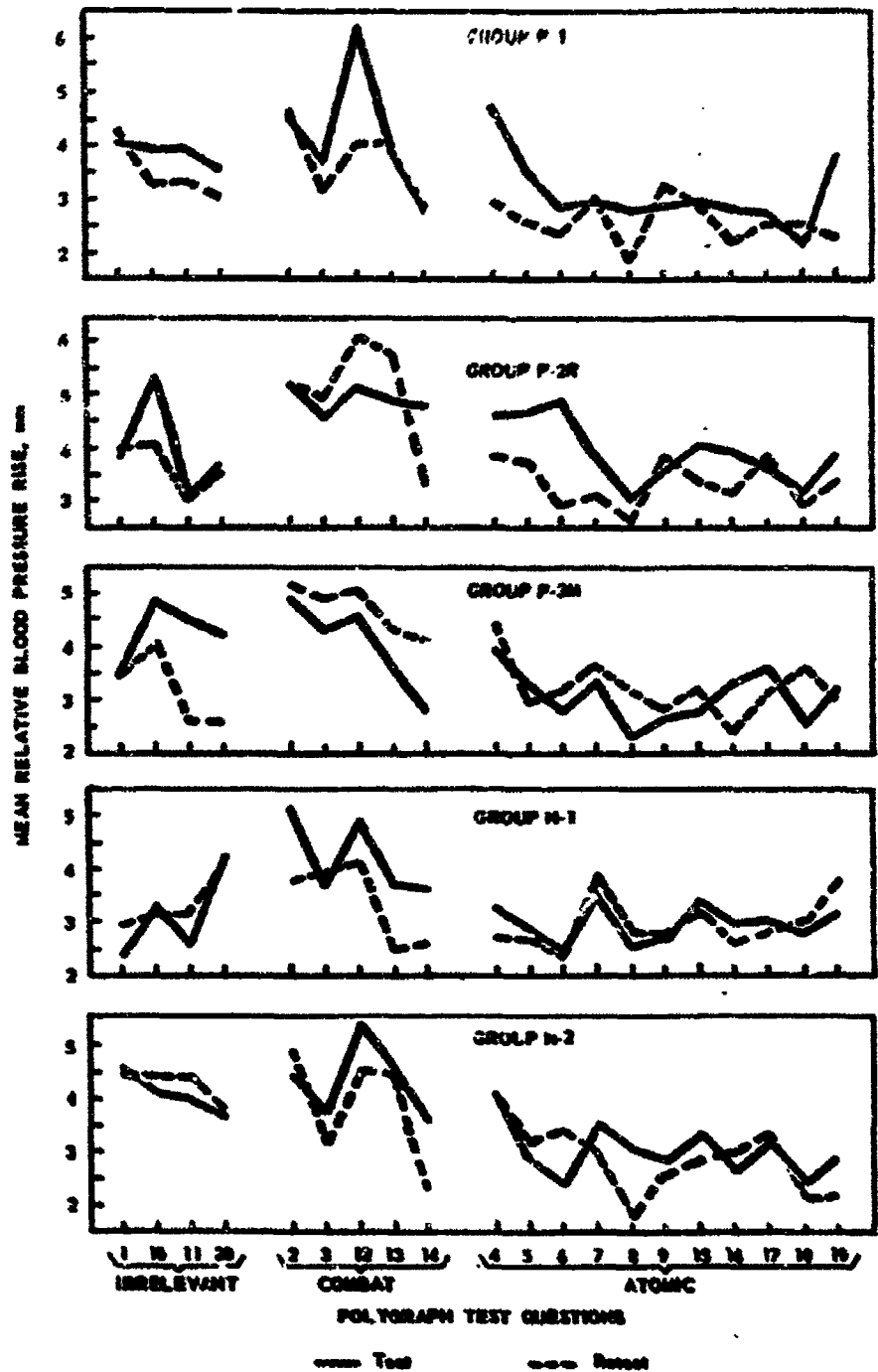


Fig. A4--Test and Retest Mean Increases in Relative Blood Pressure, by Question, Shot 6

SECURITY **RESTRICTED** INFORMATION

participated in the maneuver, whether it was the first or second test,* or whether or not the troops received regular indoctrination.

The Effect of Maneuver Participation Upon Responses. To test the effect of participation by troops in the maneuver on their physiological responses to A-bomb and combat questions, changes in the magnitude of the difference between responses to A-bomb and combat questions from the first to the second test were examined. Table A5 indicates that there was no statistically significant difference in the responses of participant Group P-1 troops to these types of questions. That is, the magnitude of the difference between responses to combat and A-bomb questions remained the same after the burst as it was before the maneuver began. There was a decline in the mean blood pressure responses to both types of questions from the first to the second test. On both tests, the combat questions evoked a greater emotional response than did those on the A-bomb.

On the retest, control (non-participant) Group N-1 failed to show as marked a difference between A-bomb and combat questions as was true at the time of the first test. Figure A5 shows graphically the mean changes in blood pressure response of participant and non-participant troops to A-bomb and combat questions on the test and retest. Like the participant group, the control group decreased in responsiveness to both types of questions on the retest, but showed a much greater decrease in responsiveness to combat questions. Hence, from test to retest, the magnitude of the difference between responses to the two types of questions changed markedly for the control group, but not for the participant group. But this was the result of an unexplained decrease in response to combat questions; the A-bomb questions do not show any significant change.

It must, therefore, be concluded that, within the limitations of this technique and this design, participation in the

*The Effect of Repetition of Test upon Responses. From a methodological point of view, it seemed useful to ascertain whether there were any systematic increases or decreases in blood pressure responses as a function of repeating the test. It is possible that greater familiarity with the testing situation might result in lower overall responses on a retest. The control groups were, in fact, provided as a means to permit comparison even if this overall change should occur. If systematic changes occurred from test to retest, it would be necessary to take these into account in analyzing the results.

It was found that the mean responses to the first test differed from those of the retest by only .026 mm. This is an insignificant statistical difference, the critical value being less than 1. It was assumed, therefore, that any changes from test to retest for any group were likely to result from something other than the effect of mere repetition.

TABLE AS
ANALYSIS OF THE BLOOD PRESSURE RESPONSES OF TROOPS, SIOT 6

Analysis Categories	GROUPS											
	P-1			P-2R			P-3M			N-1		
	Test	Retest	(N=27)	Test	Retest	(N=23)	Test	Retest	(N=26)	Test	Retest	(N=23)
Atomic - Combat Comparison												
Mean	-1.111	-1.110		-1.733	-1.733		-1.251	-1.445		-1.204	-1.401	
Standard Deviation	.2353	.1950		.2373	.2357		.2103	.2354		.2597	.2230	
Critical Ratio	4.72 ^a	5.69 ^a		4.37 ^a	6.78 ^a		4.03 ^a	6.03 ^a		4.64 ^a	1.80	
Test-Retest												
Difference	.001			.786			.194			.803		
Critical Ratio	.60327			2.342 ^b			.095			2.346 ^b		
Mean, Atomic	3.148	2.616		3.972	3.395		3.087	3.255		3.003	2.970	
Mean, Combat	4.259	2.726		4.922	5.130		3.338	4.700		4.207	3.370	
Mean, Combined	3.495	2.662		4.269	3.938		3.478	3.707		3.380	3.095	

^aSignificant at 1 percent level of confidence.

^bSignificant at 2 percent level of confidence.

Desert Rock maneuver did not effect significant changes in troops' physiological-emotional reactions to A-bomb questions.

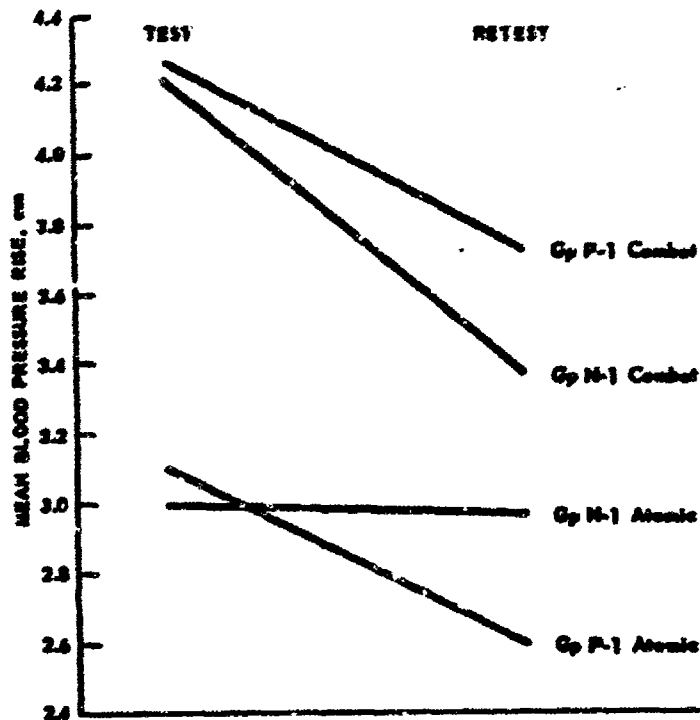


Fig. A5—Mean Blood Pressure Response of Participant and Non-participant Troops to A-bomb and Combat Questions, Shot 6

The Effect of Indoctrination on Responses. Table A5 and Fig. A6 present the mean responses of participant Groups P-2R and P-3M to A-bomb and combat questions. Group P-2R received the full indoctrination course at Camp Desert Rock, whereas Group P-3M received minimal indoctrination. Both groups were tested within one day of each other at Desert Rock after participating in the maneuver, and again, approximately three weeks later, at their home camp. Group P-2R was tested for the first time the day of the burst, while Group P-3M was tested the following day.

The data presented in Table A5 and Fig. A6 are of interest in several respects. In the first place, the mean

blood pressure response to A-bomb plus combat question was higher for the indoctrinated than for the non-indoctrinated troops; this is true for both the test and the retest. The difference, however, is much greater for the original test, the groups differing in their over-all response by only 0.2 mm at the time of the retest. In other words, the groups

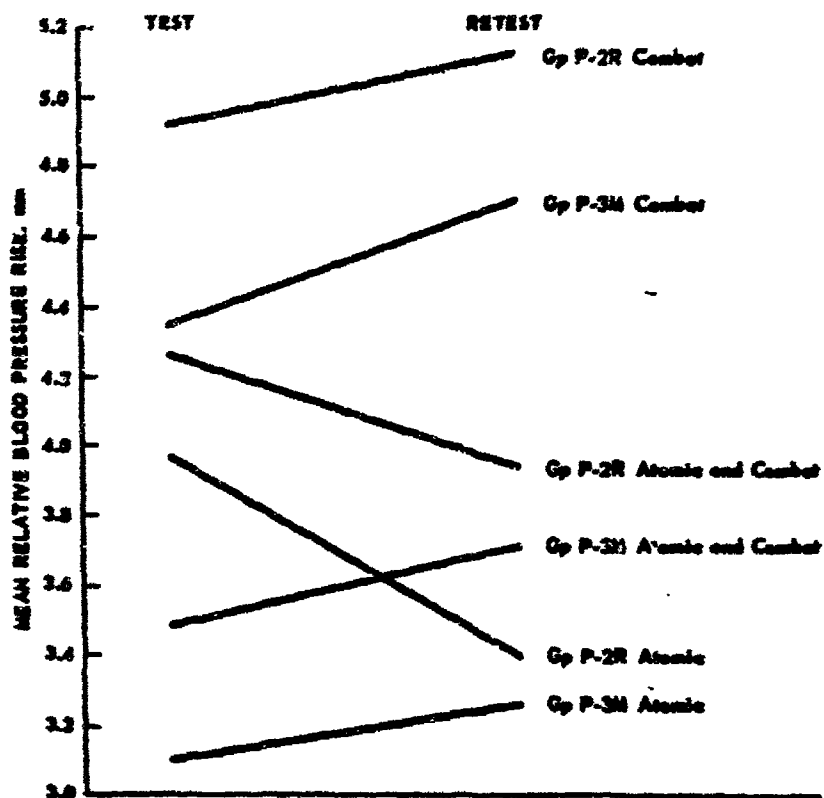


Fig. A6—Mean Blood Pressure Response of Regularly and Minimally Indoctrinated Troops to A-bomb and Combat Questions, Shot 6

seem to have been quite divergent in their over-all responsiveness to the first test, but became quite similar in their responses 19 days later. To what extent, if any, this difference is a function of receiving or not receiving full indoctrination is problematical; since Group P-2R was tested just after the burst maneuver, it may be that fatigue, the recency of the burst experience, and so forth, were the principal causative factors.

When the combat and A-bomb responses are separately examined, it is seen that the difference between response to A-bomb and combat type questions is not significant from test to retest for the non-indoctrinated troops ($CR=.19$), whereas the indoctrinated troops changed significantly from test to retest in the difference between their responses to these types of questions ($CR=2.34$, 2 percent level of confidence). The mean blood pressure responses to these questions reveal that, whereas the non-indoctrinated troops gave small and similar rises to both A-bomb and combat questions from test to retest, the indoctrinated group demonstrated a small increase in combat questions, but showed a sharp and significant drop in their response to A-bomb questions from test to retest.

The mean of responses to A-bomb questions on retest for the indoctrinated group is about at the mean of A-bomb responses for the other groups which were tested, whereas their mean for A-bomb questions on the first test, given the day of the burst, was decidedly out of line with the A-bomb responses of the other groups—more than 0.7 mm higher than the next largest mean responses. In short, the indoctrinated group appears to have demonstrated an elevated response to A-bomb questions on the first test. This may have resulted from the indoctrination, but it is more likely that the effect of being tested just after the burst maneuver was a more important factor.

Shot 3 Findings

In Shot 3, regular infantry and airborne infantry troops were given polygraph tests before and after participation in the A-bomb maneuver. This study was designed to answer the questions "Do troops from different branches of the Army differ in their emotional reactions to atomic dangers?" and "Are troops' emotional reactions to atomic dangers changed as a result of participation in an atomic maneuver?" The answers to both of these questions were negative.

Because of the nature of the Shot 3 blood pressure response records,* the data were not analyzed extensively, and are discussed here only briefly. Table A6 presents the mean blood pressure response to each polygraph question of airborne and infantry troops on the before and after D Day tests. In order to

*For a fuller discussion of the unreliability of these data, see discussion in previous section, "Varying Reliability of the Data."

TABLE A6

MEAN INCREASES IN RELATIVE BLOOD
PRESSURE, MM, BY TEST QUESTION
SHOT 3

Question	AIRBORNE (N=19)		INFANTRY (N=20)	
	Before D Day	After D Day	Before D Day	After D Day
1.	2.47	3.21	2.10	2.25
2.	3.32	3.12	2.89	3.28
3.	3.37	4.61	3.00	2.42
4.	4.22	3.3.	2.95	3.40
5.	3.47	2.44	3.50	3.20
6.	2.94	3.37	2.79	2.63
7.	3.78	3.11	2.95	2.75
8.	3.58	4.00	2.68	3.05
9.	2.37	2.28	3.42	2.85
10.	2.47	3.00	2.25	3.50
11.	3.06	3.00	1.94	1.37
12.	4.47	3.11	3.00	3.26
13.	3.17	3.74	2.53	3.11
14.	3.83	2.80	2.39	2.63
15.	2.35	2.68	2.78	2.28
16.	2.41	2.42	2.18	2.37
17.	3.88	2.58	2.67	3.53
18.	3.38	1.47	2.06	2.89
35.	3.11	2.00	2.84	1.95
36.	3.00	3.00	3.71	2.90
37.	3.28	3.32	2.84	2.45
38.	3.17	2.53	2.53	3.10
39.	3.39	3.00	2.44	3.00
40.	3.11	2.85	3.00	2.55
41.	2.84	2.95	2.79	3.25
42.	3.30	2.68	3.21	2.80
43.	2.95	3.00		
44.	3.89	4.48		
45.	2.53	3.26		
46.	2.42	2.68		
47.	3.61	2.16		

compare the emotional responses of airborne and infantry troops to the A-bomb questions, the mean blood pressure responses of these two groups were plotted. In Fig. A7 the before D Day comparison is shown. It is evident that there are no systematic differences in the emotional responses of the two types of troops

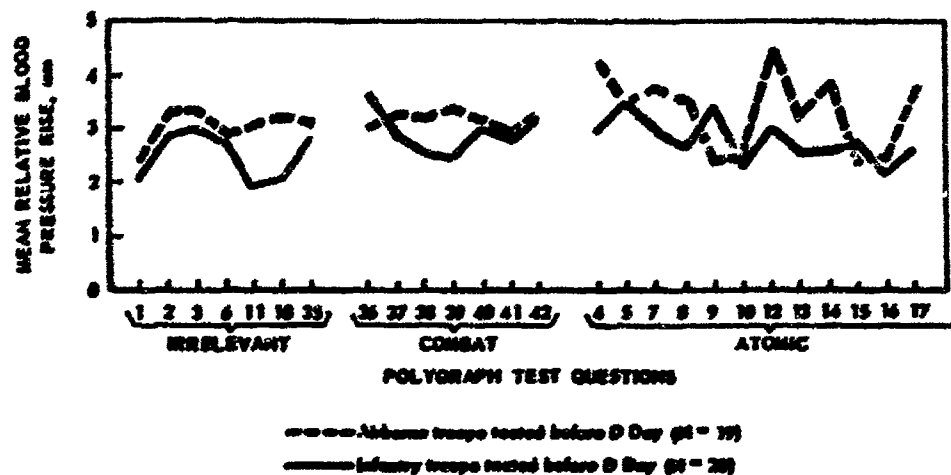


Fig. A7—Mean Increases in Relative Blood Pressure, by Question, for Airborne and Regular Infantry Troops, Shot 3

to the atomic danger questions. The after D Day re-test comparison also shows no marked or clear-cut difference in the emotional response patterns of airborne and infantry troops.

To test whether participation in the atomic maneuver changed troops' emotional responses to atomic dangers, a comparison was made of the blood pressure responses of troops tested before and after D Day. Since airborne and infantry troops did not appear to differ in their responses, the two groups were combined for this comparison. Figure A8 presents the mean blood responses of Shot 3 troops tested before and after participation in the maneuver. No systematic or marked changes in emotional responses to the A-bomb questions are evident. These data lend further support to the findings from Shots 6 and 8; participation in an atomic maneuver apparently has little or no effect on troops' emotional reactions to atomic dangers.

Comparisons Among Troops Tested in the Three Shots.

Since the troops studied in the first atomic maneuver, DESERT ROCK I, were drawn from a select population of soldiers (air-

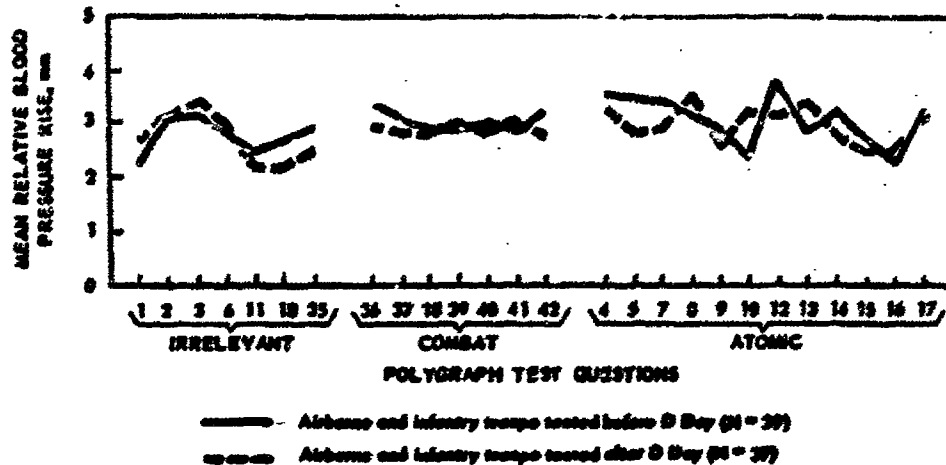


Fig. A8—Mean Increases in Relative Blood Pressure, by Question, for Troops Tested Before and After Maneuver Participation, Shot 3

borne troops), there was doubt as to whether the findings could be extended to troops of other branches of the Army. In DESERT ROCK IV, several different types of troops, participating in three different shots, were studied. By comparison of the polygraph response records of groups participating in the various Exercise IV maneuvers, it is possible to ascertain whether there are differences in emotional responses to atomic dangers among different types of troops participating in the different shots.

In Shot 3, regular and airborne infantry troops were tested; in Shot 6, armored infantry troops were tested; in Shot 8, service troops constituted the test population. Figure A9 shows the mean blood pressure response to each question of the participant troops tested in each shot. Since no differences were found between the responses of infantry and airborne troops in Shot 3, these two groups were combined for the purposes of this over-all comparison. Only responses to those questions in the Shot 3 polygraph test which were comparable to questions on the Shots 6 and 8 test were used in this comparison.

It is evident that for all three shot populations, the blood pressure responses to A-bomb questions are markedly similar. Group differences in mean response for most questions are small, and there is clearly no differential pattern of response by participant troops tested in the three maneuvers. It is interesting to note that the three groups of subjects do tend to show consistent differences in their emotional reactions to the irrelevant

and combat questions. Whatever the reasons for such differences, they serve to emphasize the overlap and similarity of response to the A-bomb questions.

The finding, that different types of Army troops participating in the three separate atomic maneuvers react to atomic dangers in about the same way, would seem to give additional weight to the polygraph findings from the separate shots. For this reason, and because of the consistency of the results obtained through the measurement of troops' blood pressure responses to polygraph

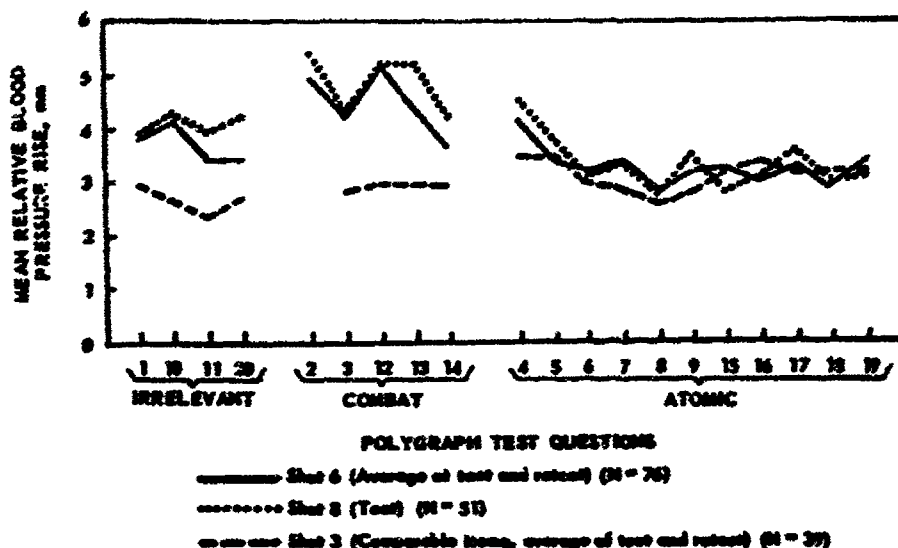


Fig. A9—Mean Blood Pressure Response by Question, for Troops Participating in Shots 3, 6, and 8

questions, the general conclusions and recommendations of the total study rely more heavily on the physiological evidence which was obtained in all shots than on the verbal data gathered by interview and questionnaire methods in one or two shots.

ANALYSIS OF VERBAL RESPONSES TO QUESTIONS

Although questions were used on the polygraph test primarily as stimuli to elicit physiological reactions, the verbal responses of troops to these questions are of interest in themselves. There is some reason to believe that answers to questions presented in

TABLE A7
VERBAL RESPONSES TO POLYGRAPH QUESTIONS^a

Sheet 3										Sheet 4									
Participations										Non-participations									
P-1					P-2					P-3					P-4				
Quest. No.	Inf. Before	Inf. After	Air Before	Air After	Quest. No.	Inf. Before	Inf. After	Air Before	Air After	Quest. No.	Inf. Before	Inf. After	Air Before	Air After	Quest. No.	Inf. Before	Inf. After	Air Before	Air After
(20-23)					(20-23)					(20-23)					(20-23)				
1	84	89	95	96	1	76	78	84	81	1	76	78	84	81	1	67	73	78	83
2	84	89	95	96	2	87	89	96	91	2	87	89	96	91	2	79	87	92	97
3	84	89	95	96	3	44	55	64	58	3	44	55	64	58	3	62	65	68	73
4	84	89	95	96	4	77	77	84	84	4	77	77	84	84	4	74	76	78	81
5	84	89	95	96	5	33	33	41	33	5	33	33	41	33	5	46	46	48	51
6	84	89	95	96	6	63	63	69	64	6	63	63	69	64	6	52	52	53	56
7	84	89	95	96	7	48	48	50	50	7	48	48	50	50	7	56	56	57	60
8	84	89	95	96	8	85	85	88	88	8	85	85	88	88	8	66	66	67	70
9	84	89	95	96	9	82	82	84	84	9	82	82	84	84	9	54	54	55	58
10	84	89	95	96	10	82	82	84	84	10	82	82	84	84	10	54	54	55	58
11	84	89	95	96	11	82	82	84	84	11	82	82	84	84	11	54	54	55	58
12	84	89	95	96	12	82	82	84	84	12	82	82	84	84	12	54	54	55	58
13	84	89	95	96	13	82	82	84	84	13	82	82	84	84	13	54	54	55	58
14	84	89	95	96	14	82	82	84	84	14	82	82	84	84	14	54	54	55	58
15	84	89	95	96	15	82	82	84	84	15	82	82	84	84	15	54	54	55	58
16	84	89	95	96	16	82	82	84	84	16	82	82	84	84	16	54	54	55	58
17	84	89	95	96	17	82	82	84	84	17	82	82	84	84	17	54	54	55	58
18	84	89	95	96	18	82	82	84	84	18	82	82	84	84	18	54	54	55	58
19	84	89	95	96	19	82	82	84	84	19	82	82	84	84	19	54	54	55	58
20	84	89	95	96	20	82	82	84	84	20	82	82	84	84	20	54	54	55	58
21	84	89	95	96	21	82	82	84	84	21	82	82	84	84	21	54	54	55	58
22	84	89	95	96	22	82	82	84	84	22	82	82	84	84	22	54	54	55	58
23	84	89	95	96	23	82	82	84	84	23	82	82	84	84	23	54	54	55	58

Percent of subjects answering polygraph questions in self-confident and satisfaction with mail, confidence and look of four
back and under divisions.

a polygraph situation may represent a more frank and honest expression of the subject's real feelings than might be elicited through conventional interview or questionnaire methods. The realization that his physiological reactions are being recorded, and are under the observation of the polygraph operator, may discourage the average subject from trying to cover up his real feelings and thus may induce more honest replies than might otherwise be obtained. For this reason, the verbal responses of troops to the polygraph test have been treated in somewhat greater detail than the verbal data gathered by interview and questionnaire techniques.

The main series of polygraph questions, used in Shots 6 and 8, consisted of eleven questions pertaining to the A-bomb, five questions concerning combat situations, and four irrelevant questions unrelated to either combat or A-bomb situations. In Shot 3, a similar but somewhat longer series of questions was used. In order that the verbal responses of troops participating in all three shots might be compared, only those in the Shot 3 series which correspond to questions in the Shot 6 and 8 series have been used in this analysis. Table A7 shows the verbal response to each question of all groups tested in each shot.

Comparison of Responses by Three Populations

As a first step in the study of troops' verbal responses to the polygraph questions, a comparison was made of the responses of troops tested during the three maneuvers, Shots 3, 6, and 8. For this comparison the verbal responses of troops at Camp Desert Rock on their first polygraph test were used. These troops included the following:

- Shot 3: 39 airborne and infantry troops, tested before D Day of their first A-bomb maneuver.
- Shot 6: 67 armored infantry troops, tested after D Day of their first A-bomb maneuver.
- Shot 8: 51 service troops, some with and some without previous A-bomb maneuver experience, tested before D Day.

Comparisons among the verbal responses of these different types of troops must be considered in the light of the facts that the time of testing, the nature of troop participation in the maneuver, the size of the bomb, etc., varied from one maneuver to another. The graph in Fig. A10 serves only to indicate whether or not there were any gross differences in the verbal responses of troops tested during the three maneuvers. The verbal re-

sponses to each question have been expressed in terms of the percentage of men answering in such a way as to indicate a feeling of confidence, satisfaction, or lack of fear and apprehension.

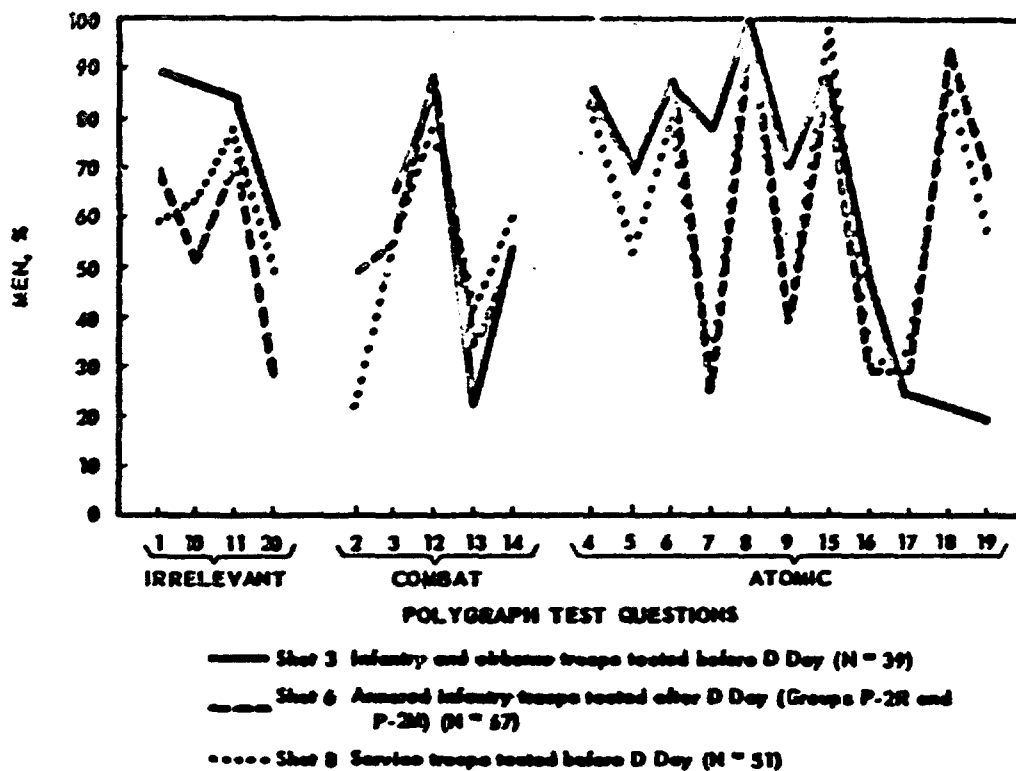


Fig. A 10—Verbal Responses Indicating Confidence in Self or Unit, or Lack of Fear in Combat and A-bomb Situations
(Troops Participating in Shots 3, 6, 8)

For the most part, the verbal response pattern for the three maneuver populations is quite similar. While there is a certain amount of variation in the percentage response of different groups to certain questions, there is little or no evidence of a tendency for the troops participating in one maneuver to respond in a manner consistently different from troops in other maneuvers.

On the irrelevant questions, there is some indication that the airborne and infantry troops were better satisfied with their units (Question 1) than were the other troops, and that the armored infantry were less satisfied than other troops with their branch of the Army (Question 20). On the combat questions there is remarkably little spread among the three groups, except for Question 2 on which a greater proportion of the armored infantry

troops expressed confidence in the combat readiness of their outfit than did the service troops. Airborne and infantry troops in Shot 3 were not asked this question.

To eight of the eleven A-bomb questions, the three troop populations responded in a very similar manner. The airborne and infantry troops in Shot 3 expressed less fear of walking through ground zero after an A-bomb burst (Question 7) than did armored infantry and service troops, but expressed greater concern than other troops about the danger of fire-flash burns if caught in the open by an A-bomb burst (Question 19). On Question 9, relating to the danger of radiation sickness, the difference between responses of troops in Shot 3 and those in Shots 6 and 8 may be due to a change in the wording of the question on the test given in Shot 3.

Although certain dissimilarities are apparent, the three maneuver populations did not seem to exhibit any regular and consistent differences in their pattern of verbal response to irrelevant, combat, or A-bomb questions on the polygraph test.

Responses of Airborne and Infantry Troops

Findings from the first A-bomb exercise in November 1951 indicated that troops verbally expressed a considerable degree of confidence and a lack of fear of the A-bomb. The troops participating in that exercise were members of an airborne outfit, and might be considered atypical of Army troops as a whole. It seemed desirable, therefore, to compare the reactions of such select troops with those of more typical infantry troops. Shot 3 of DESERT ROCK IV, in which both airborne and regular infantry troops participated, provided the opportunity for such a comparison. The results are shown in Fig. All.

The hypothesis that relatively select airborne troops exhibit a degree of confidence and lack of fear in A-bomb maneuvers which exceed that of regular infantry troops is not confirmed by an analysis of the verbal responses of these troops to the polygraph questions. As is shown in Fig. All, airborne troops verbally expressed a somewhat lesser degree of confidence than regular infantry troops to some of the A-bomb questions, and a greater degree of confidence to others. Thus verbal response data provide no real evidence that regular infantry troops tend to be generally more apprehensive than airborne troops about A-bomb dangers. It will be noted that the same lack of consistency occurred in the verbal responses to combat questions by these two groups.

Only in the case of the irrelevant questions is there any evidence that airborne troops responded differently. Here a slightly greater proportion of airborne than infantry troops expressed satisfaction in their outfit (Question 1) and said that they were in good physical condition (Question 11), and a markedly larger proportion of airborne than infantry troops expressed satisfaction in their Army branch assignment (Question 20).

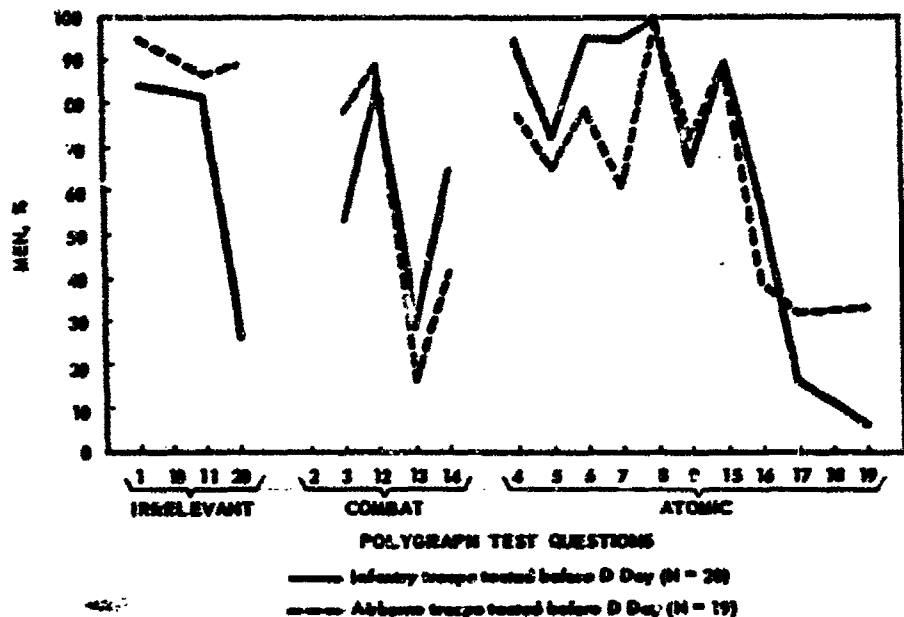


Fig. A11—Verbal Responses Indicating Confidence in Self or Unit, or Lack of Fear in Combat and A-bomb Situations (Infantry and Airborne Troops, Shot 3)

When the "after D Day" responses of airborne and infantry troops are compared, the same result is found. According to their verbal responses, select airborne troops did not exhibit a consistently greater degree of confidence concerning A-bomb dangers than did typical infantry troops.

The Effect of Participation on Verbal Responses

One of the most interesting and important questions which this study sought to investigate was what effect participation in an atomic maneuver has on troops' attitudes and feelings about the A-bomb. In the Shot 6 experiment, two groups of armored

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infantry troops were given the polygraph test; one group participated in the atomic maneuver, the other remained at home base and did not participate. A comparison of the verbal responses of these two groups (see Fig. A12) on their first polygraph test may give some indication of the over-all effect of the exercise on the participating troops. It is evident that the two groups are com-

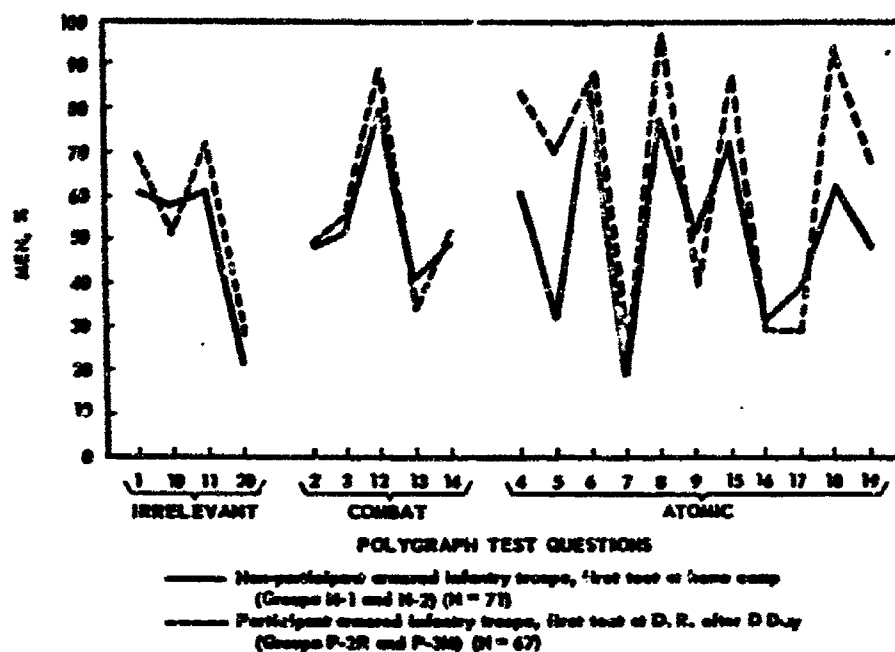


Fig. A12—Verbal Responses Indicating Confidence in Self or Unit, or Lack of Fear in Combat and A-bomb Situations (Answered Infantry Participants and Non-participants, First Test, Shot 6)

parable in terms of their answers to the irrelevant and combat questions. On the A-bomb questions, however, there was a tendency for troops who participated in the maneuver (and were tested at Camp Desert Rock shortly after D Day) to show less apprehension and fear of the A-bomb than the control group of non-participants.

Participant troops expressed greater faith in the experts' knowledge and use of the A-bomb in maneuvers (Question 4), less fear of being four miles away from an A-burst (Question 5), less fear of radiation four miles from an atomic explosion (Question 8), less fear of blacking out or being sick during an A-bomb ex-

plosion (Question 15), less fear of blast effects of an A-bomb burst (Question 18), and less concern over possible injuries from burns if exposed to an A-bomb flash (Question 19). On the other hand, participants were somewhat less confident than non-participants concerning the danger of radiation sickness (Question 9) and somewhat more apprehensive about handling equipment exposed to atomic radiation (Question 17).

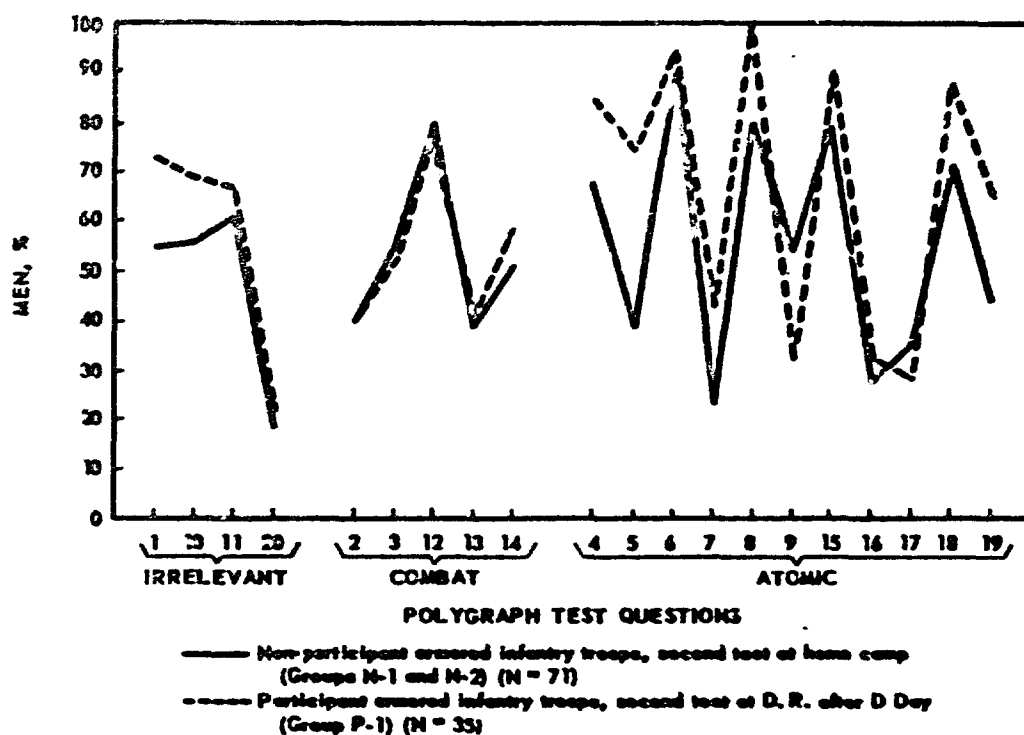


Fig. A13—Verbal Responses Indicating Confidence in Self or Unit, or Lack of Fear in Combat and A-bomb Situations
(Armored Infantry Participants and Non-participants, Second Test, Shot 6)

Neither participant nor non-participant troops expressed a fear of being blinded by watching an A-bomb explosion at a distance of four miles (Question 6). A majority of both groups indicated that it was not safe to walk through ground zero in regular field clothing right after an A-bomb airburst (Question 7), and felt that they would not be safe occupying a foxhole two miles away from an atomic explosion (Question 16).

As a further check on the effect of the maneuver on troops' attitudes, the verbal responses of a second participant group of armored infantrymen tested after D Day for the second time were

compared to the verbal responses of the non-participant troops on their second polygraph test. The results for this retest comparison shown in Fig. A13 are consistent with the results for the test comparison: the troops who had the maneuver experience showed a generally lower level of anxiety and apprehension concerning A-bomb dangers than did those who were not participants in the atomic training maneuvers.

The Effect of Indoctrination on Verbal Responses

The difference between participants and non-participants in their verbal responses to A-bomb questions might be attributed to the D Day experience alone, including participation in an atomic

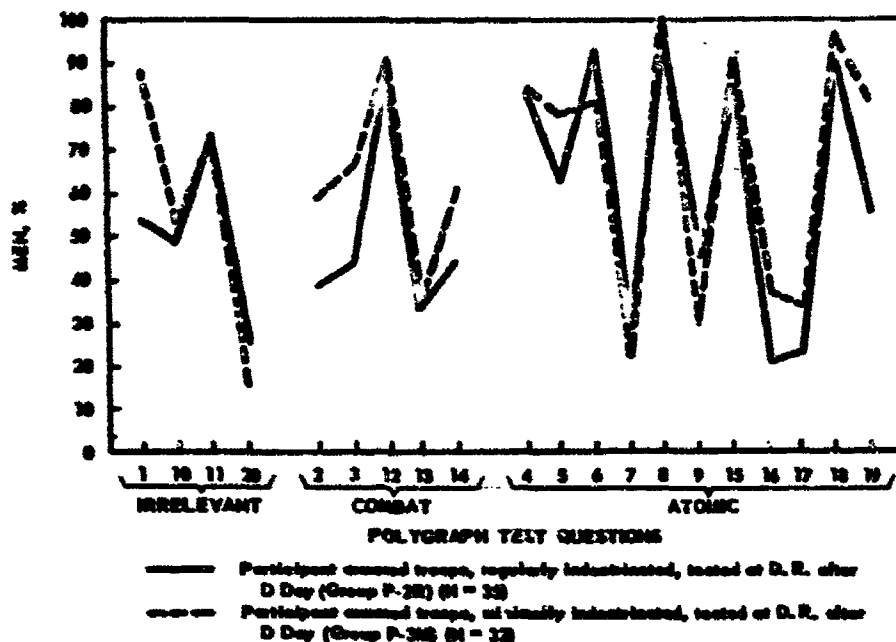


Fig. A14—Verbal Responses Indicating Confidence in Self or Unit, or Lack of Fear in Combat and A-bomb Situations (Regularly and Minimally Indoctrinated Armed Infantry Participants, Shot 4)

maneuver, witnessing an A-bomb explosion, and advancing close to ground zero, all of which proceeded without harm to any of the troops. It might, however, also be attributed to the considerable indoctrination which the participant troops received prior to D Day, and which the non-participants did not receive. In an effort

to isolate the effects of indoctrination from the effects of the maneuver itself, one participant group of armored infantry was given only a minimal amount of indoctrination prior to the atomic burst. This minimally indoctrinated group, then, can be compared with the regularly indoctrinated group to see whether the after D Day verbal responses of these two groups differed. This comparison is presented in Fig. A14. It is apparent that there is little difference between the verbal responses of regularly indoctrinated and minimally indoctrinated troops to questions relating to the A-bomb. Although the size of this sample is too small to allow definite conclusions, these results suggest that regular atomic energy indoctrination may be less effective than actual participation in an A-bomb exercise in reducing anxiety.

The Effect of Previous Experience on Verbal Responses

In a further attempt to estimate the effects of A-bomb maneuver experience on the attitudes and feelings of troops, two groups of soldiers were tested before D Day in the Shot 8 exercise. These troops were Camp Desert Rock station complement

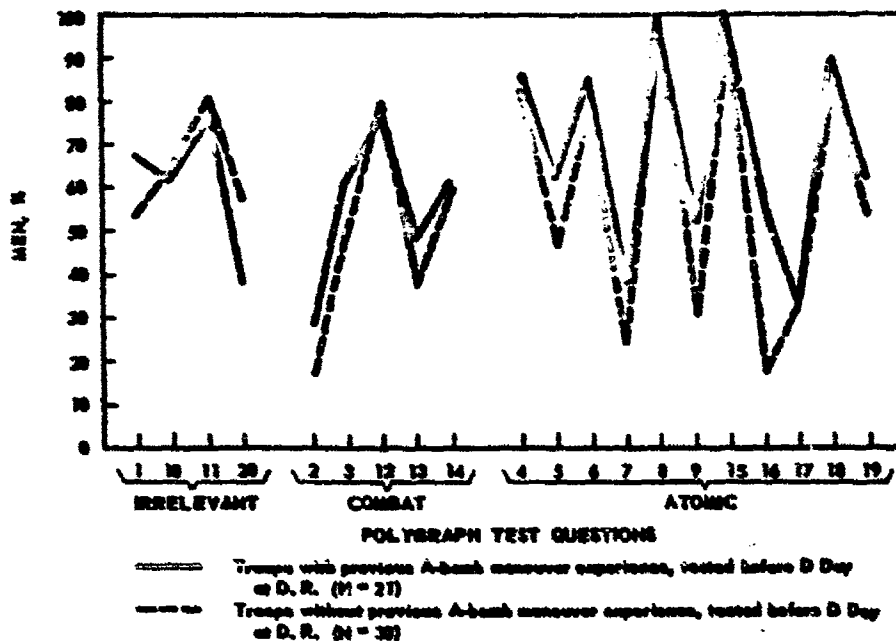


Fig. A15—Verbal Responses Indicating Confidence in Self or Unit, or Lack of Fear in Combat and A-bomb Situations (Experienced and Inexperienced Troops, Shot 8)

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personnel, some of whom had had previous A-bomb experience either as maneuver participants or as service troops (truck drivers, etc.) to participants, and hence witnessed the explosion; and some of whom were inexperienced. The verbal responses of these two groups of men to the polygraph test questions are shown in Fig. A15. Although differences between the two groups' responses to the A-bomb questions were very small in most cases, the experienced troops rather consistently expressed less fear and apprehension than the inexperienced troops about A-bomb dangers. On nine of the eleven questions, a somewhat greater proportion of experienced than inexperienced troops expressed confidence; to one question, the verbal responses of the two groups were the same, and to only one question (Question 8, dealing with the danger of radiation to troops in foxholes four miles from an A-burst) was the percentage of "confident" responses smaller for the experienced than for the inexperienced group.

Changes in Responses from Test to Retest

Although the foregoing comparisons of verbal responses by different troop populations to A-bomb questions provide some interesting hypotheses and, perhaps, indicate certain general trends, the results of these comparisons should not be given too much weight. Most of the groups tested were small, and differences among them may, in many cases, be a function of chance fluctuation, not representative of true differences in the verbal responses of the populations from which these samples were drawn. As a further check on the results presented thus far, an analysis was made of the test-retest data for the Shot 3 and 6 groups. (The troops in Shot 8 were given the polygraph test only once, before D Day.)

Figure A16 illustrates the percentage shifts in verbal response for the Shot 3 airborne and infantry troops tested before and after D Day at Desert Rock, the Shot 6 armored infantry troops tested at home camp before indoctrination and participation in the maneuver and retested after D Day at Desert Rock, and the armored infantry troops who did not participate in an atomic maneuver and were tested twice at their home base.

While the changes in the responses of all four groups to combat and irrelevant questions were slight, changes for the atomic questions were more extreme. For the participant groups, practically all changes were positive, indicating an increase in feelings

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of confidence and safety in A-bomb situations. On most of the questions the participant troops in Shot 6 showed percentage increases which exceeded those of the participant troops in Shot

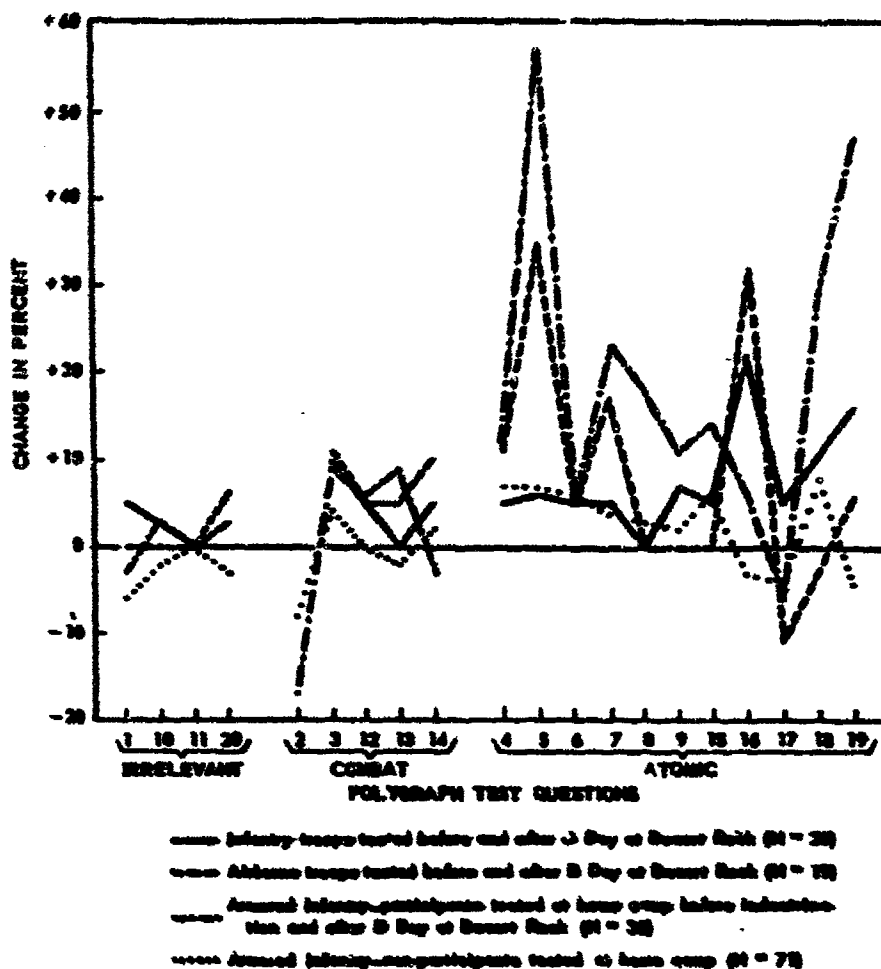


Fig. A16—Change from Test to Retest, Indicating Confidence in Self or Unit, or Lack of Fear in Combat and A-bomb Situations (Participant and Non-participant Troops, Shots 3 and 4)

3. Because Shot 6 troops were first tested before indoctrination, whereas Shot 3 troops were given their first test shortly before D Day and after many of the men had received indoctrination, this suggests that atomic energy indoctrination, as well as par-

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participation in the maneuver, plays a part in decreasing troops' anxieties and apprehensions concerning A-bomb dangers.

The Effect of Indoctrination on Maintenance of Attitudes

As has been indicated previously, the type of atomic energy indoctrination does not seem to be of great importance in changing the attitudes of troops participating in an A-bomb maneuver. After D Day on Shot 6, minimally indoctrinated troops responded

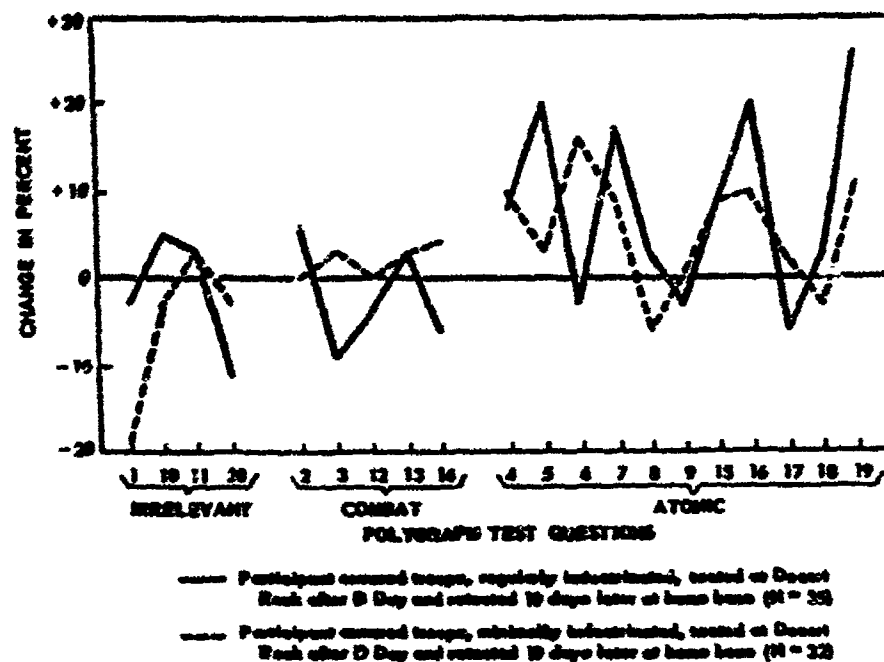


Fig. A17—Change from Test to Retest, Indicating Confidence in Self or Unit, or Lack of Fear in Combat and A-bomb Situations (Regularly and Minimally Indoctrinated Troops, Shot 6)

in very much the same way as troops who had received the regular indoctrination series. It was recognized, however, that troops who were given a minimal amount of instruction might later show a greater rise in feelings of anxiety and tension concerning A-bomb dangers than would regularly indoctrinated troops. This "regression" phenomenon was one which appeared in regularly indoctrinated troops participating in the first Desert Rock Exercise in 1951. As a partial and tentative check on this hypothesis, an

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analysis was made of the change in verbal responses of minimally and regularly indoctrinated troops from their first test after D Day at Desert Rock to their second test administered 19 days later at home camp. These data are presented in Fig. A17. No consistent differences between the two groups in verbal response change are apparent. On the atomic questions, both groups tended to increase rather than decrease in their feelings of confidence and safety regarding A-bomb situations. It must be emphasized that groups tested were rather small and these findings are only tentative, at best. They seem to suggest, however, that minimal indoctrination before participation in an A-bomb maneuver is as effective as regular indoctrination in maintaining troops' attitudes of confidence concerning A-bomb dangers for a period of at least 19 days after the maneuver.

ANALYSIS OF FREE ASSOCIATION RESPONSES

Word association stimuli were included in the polygraph test on an exploratory basis. Most of the word stimuli were taken from standard word association lists, and some new words, such as "A-bomb," were added. The subject was asked to respond as quickly as possible with the first word that came to mind (see instructions in the last section of this Appendix). The operator indicated on the polygram the point at which the stimulus was presented and the point at which the response was made, and he also recorded the response itself. The polygram thus yielded three reaction measures: reaction time, verbal response, and physiological (blood pressure) reaction. It was hypothesized that emotional disturbance about the A-bomb maneuver, and anxiety concerning A-bomb dangers, might be revealed in one or more of these measures. To the standard stimulus "dust," for example, an apprehensive subject might show a lengthened reaction time, and give an A-bomb-related response such as "radioactive," at the same time showing a rise in relative blood pressure on the polygraph chart. Using such indices from the word association test, comparisons were planned of possible differences between participant and non-participant troops, participants tested before and after D Day, minimally and regularly indoctrinated troops, and troops with and without previous A-bomb experience.

Analysis of Results

Verbal responses to the word stimuli were tabulated for each group tested in each shot. A preliminary analysis of the frequency of A-bomb type responses to the word stimuli revealed no differences among the test groups. That is, participants did not give A-bomb responses more frequently than non-participants, regularly indoctrinated troops did not differ from minimally indoctrinated troops, and so forth. A preliminary analysis of the frequency of fear-type responses to such A-bomb-related stimuli as "blast," "burn," "dust," and "A-bomb" also revealed no consistent or marked differences between groups of subjects; participants did not differ from non-participants, A-bomb experienced troops did not differ from inexperienced troops, and regularly indoctrinated troops did not differ from minimally indoctrinated troops.

Examination of the blood pressure reaction data revealed that there were no significant differences from one stimulus word to another; that is, subjects did not give larger responses to A-bomb-related words than to non-A-bomb stimuli. Also, the extreme differences in mean blood pressure response between groups of subjects were selected and a t-test was run. This failed to meet the critical ratio for significance by a large margin (critical ratio = 0.732; required, 2.4). There were, then, no significant differences between groups of subjects in their blood pressure reactions to the word stimuli. It was also found that groups of subjects showed no consistent or significant differences in word association reaction time.

The inconclusive yield of this small portion of the study suggests that tests involving a combination of free association and the measurement of blood pressure changes, though they may prove useful as clinical tools when each subject can be individually judged, do not seem to be well adapted to experiments requiring comparisons among groups of subjects.

POLYGRAPH TESTS

The following are the polygraph tests given to troops at
DESERT ROCK IV:

Shots 6 and 8

The Army has asked us to make a survey of soldiers' reactions to certain problems of military life. The best way to do this is with a polygraph machine. This machine makes a record of your feelings on certain things I'll ask you about. No one in the Army will ever see your record or find out what you answer to the questions, so you can be perfectly frank and open in your replies.

Just sit down in this chair please. First, I'll put this blood pressure cuff around your arm. Rest your arm here. This tube goes around your chest. Sit forward and I'll adjust it. Now lean back.

I'll pump some air in that armband now. It will be a little uncomfortable, just as it is when the doctor takes your blood pressure, but it certainly won't harm you in any way. Now sit quietly. Closing your eyes will help you to relax. If you don't want to close your eyes, look straight ahead. Don't move your arms, legs, or body.

Are you comfortable?

Have you eaten within the last hour?

Now I am going to read you some words, one at a time, and I want you to answer as quickly as possible with the first word that comes to your mind. For example, if I say "dog" you might say "cat." Answer as quickly as you can with the first thing you think of.

1. Table
2. House
3. Dust
4. Jump
5. Sick
6. Afraid
7. Blast
8. Sheep
9. White
10. Burn
11. A-bomb

Deflate cuff

Now I'm going to ask you questions. Think carefully before answering. Answer each question with a simple yes or no. If you want to explain your answer, wait till the end. Be sure to answer either yes or no.

Inflate cuff

1. Do you think the outfit you're in is a good one?
2. Do you think your outfit is ready to go into combat now if it had to?
3. Do you ever worry about whether you'll be injured in combat?
4. Do you think the experts know enough to use A-bombs in maneuvers without danger to our troops?
5. If you were in a foxhole when an A-bomb went off 4 miles away, do you think you'd be scared?
6. If you watched an A-bomb explode 4 miles away, do you think you'd be blinded for life?

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7. Right after an A-bomb burst at 2,000 feet, would you feel safe walking through ground zero in your regular field clothing?
8. If you were in a foxhole 4 miles from an A-bomb burst, do you think the radiation would hurt you?
9. If a soldier got a bad case of radiation sickness, do you think he'd die?
10. Would you say you're the type that makes a good soldier?

Deflate cuff for brief rest

11. Would you say that you're in good physical condition now?
12. If you were sent into actual fighting now, do you think you'd do all right?
13. If you were wounded in battle and unable to shout for help, would you be afraid that the medics might not find you?
14. Do you ever worry about what might happen to you if you were taken prisoner by the enemy?
15. If you were in a foxhole 4 miles away from an A-bomb explosion, do you think you'd black out or be sick?
16. Would you feel safe in a foxhole only 2 miles away from an A-bomb burst?
17. Would you be afraid to handle equipment within 1-1/2 miles of an A-bomb burst before it's monitored?
18. If you were in a foxhole 4 miles from an A-bomb burst, do you think the blast would be dangerous?
19. If you were caught in the open 4 miles away from an A-bomb burst, do you think the fire flash would burn you?
20. If you had your choice, would you rather be in a different branch of the Army than the one you're in now?

Deflate cuff. End of test.

Shot 3

1. Are you comfortable?
2. Have you eaten anything within the last hour?
3. Do you smoke?
4. Do you think the experts really know enough to use A-bombs?
5. If you were 4 miles away when an A-bomb went off do you think you would black out or be sick?
6. Do you think the outfit you are in is a good one?
7. Would you be afraid to handle equipment within 1-1/2 miles away of an A-bomb burst, before it is monitored?
8. Would you feel safe if you were in a foxhole 2 miles away from an A-bomb burst?
9. If a soldier were to get radiation sickness, do you think he would probably die?
10. After an A-bomb burst would you feel safe advancing through ground zero wearing your regular field clothing?

Deflate cuff for brief rest

11. Would you say that you are in good physical condition now?
12. Do you think you would be scared if an A-bomb went off 4 miles away from you?
13. If you were in a foxhole 4 miles from an A-bomb burst, do you think you would be hurt?
14. If you watched an A-bomb explode 4 miles away do you think you would become permanently blind?

15. If you were in a foxhole 4 miles from an A-bomb burst do you think the radiation would hurt you?
 16. If you were in a foxhole 4 miles from an A-bomb burst do you think the fire flash would burn you?
 17. If you were in the open 4 miles from an A-bomb burst do you think the fire flash would burn you?
 18. Do you think you are getting a square deal in the company you are in now?
- Deflate cuff /or brief rest.*

Now I am going to read you some words, one at a time, and I want you to answer as quickly as possible with the first word that comes to your mind. For example, if I say "dog" you might say "cat." Answer as quickly as you can with the first thing you think of.

19. Table
20. House
21. Dust
22. Sheep
23. Jump
24. Tank
25. Sick
26. Bread
27. Afraid
28. Tower
29. Flash
30. Shock
31. Radio
32. White
33. Burn
34. A-bomb

Deflate cuff /or brief rest

35. If you had your choice, would you rather be in a different branch of the Army than the one you are in now?
36. Do you think you might be sent into combat soon?
37. If you were sent into actual fighting now, do you think you would do all right?
38. Do you ever worry about whether you will be injured in combat?
39. If you were wounded in battle and unable to shout for help, would you be worried that the medics might not find you?
40. Do you ever worry about what might happen to you if you were taken prisoner by the enemy?
41. Would you volunteer to advance into a new area before it had been cleared of anti-personnel mines?
42. Would you leave your foxhole to rescue a wounded buddy during an artillery barrage?

Deflate cuff

Questions asked only of airborne troops

43. Have you ever felt like refusing to jump after the take off?
44. Do you wonder sometimes if you'll freeze at the door when your turn comes?
45. Do you often get scared that your chute won't open?
46. If it didn't open do you think you could get your chest chute open in time?
47. As you jump do you worry about tangling in your lines?

APPENDIX B
INTERVIEWS WITH INDIVIDUAL PARTICIPANTS

CONTENTS

	Page
DESCRIPTION OF METHOD	75
RESULTS: SHOT 6	76
RESULTS: SHOT 8	83
TABLES	
B1-B14. Interview Responses to Questions	
B1. Questions 1, 2, 7, and 8, Shot 6	77
B2. Question 3, Shot 6	78
B3. Question 4, Shot 6	80
B4. Questions 5 and 6, Shot 6	81
B5. Question 10, Shot 6	82
B6. Question 11, Shot 6	83
B7. Questions 1 and 2, Shot 8	84
B8. Question 3, Shot 8	85
B9. Question 4, Shot 8	86
B10. Questions 5 and 6, Shot 8	87
B11. Questions 7 and 8, Shot 8	88
B12. Question 9, Shot 8	89
B13. Question 10, Shot 8	89
B14. Question 11, Shot 8	90

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DESCRIPTION OF METHOD

Individual interviews with troops participating in the Desert Rock maneuvers were included in the research design because it was felt that they might provide valuable additional data. While the content of interview questions was rather similar to the content of questions used in the polygraph experiment and in the questionnaire, individual interview techniques have some unique features. In the first place, the verbal presentation of a question in a face-to-face setting insures a better understanding on the part of the respondent, since he has the opportunity to ask for amplification, clarification, etc. This is not possible where the question is printed in a booklet in which the soldier writes or checks an answer. Individual verbal interviews also obviate the misunderstanding arising from lack of facility or accuracy in reading which is a risk inherent in the printed question schedule.

Secondly, interview methods allow questions to be presented in different forms from those required in questionnaire or polygraph techniques. In order to interfere with the physiological response record as little as possible, all the questions in the polygraph section were phrased in such a way as to require a "yes" or "no" answer. The questionnaire items were, necessarily, presented so as to permit scoring of the responses; multiple choice questions were used. Both methods, therefore, imposed severe restrictions on the phrasing of the subjects' replies. Interview methods, on the other hand, allow the respondent to make fine distinctions, to qualify his answers, and, in short, to give what to him may be more complete and satisfactory answers.

Finally, the rapport established between the interviewer and respondent may, to some extent, have the effect of calling forth more candid replies. For these reasons, it was thought that individual interviews would be a valuable addition to the total study.

Each of the two interviewers used a separate tent. A third tent, between the two interview tents, was used as a check-in point and waiting area.

At the beginning of each interview the interviewer asked the soldier to have a chair on the other side of the small field table and introduced himself as a civilian from a university who had been asked to find out something about what soldiers know and how they feel about the A-bomb. It was emphasized that although the soldier's name was known to the interviewer, no names would be reported to the Army at any time so that the soldier was perfectly free to say what he thought. The soldier was told that

only summary results would be reported to a research organization in Washington. He was further assured that the investigation was general and that he was free to tell what he thought. Before beginning to administer the questions the interviewer always made the following explanation: "In asking various questions, I will always be talking about a Hiroshima-type A-bomb burst 2000 feet above ground."

A special effort was made to insure that the soldiers understood each question. If necessary, the question was repeated or paraphrased in order to help the respondent's understanding of it. The interviewer took particular care not to suggest any answer. The interviews lasted from 6 to 12 minutes.

Interviews in Shot 6

The interviewing was conducted at Camp Desert Rock on 26/27 May 1952, during the day and a half following the A-bomb tower Shot 6. Eleven questions were administered. Of these, Question 9, was later dropped from the analysis, since the replies clearly indicated that the subjects had failed to understand its meaning.

One hundred and one enlisted men from the 701st Armored Infantry Battalion of the 1st Armored Division were interviewed. It was later ascertained that one subject had not actually participated in the maneuver. His interview was discarded, reducing the number to 100. Of this group, 45 interviewees were men who had received regular atomic energy indoctrination before the maneuver; 55 were men who had received only a minimal amount of this indoctrination.

RESULTS: SHOT 6

The results of the interviews obtained in Shot 6 are shown in Tables B1 through B6. Each table presents the question, the step-intervals of the distribution, and the percent of the interview responses falling into each step-interval. The step-intervals were set up after a complete tabulation of all responses was made; those intervals were selected which most truly represented the distribution of responses. Medians were computed on the basis of the original tabulation of all answers.

If the minimally indoctrinated and the regularly indoctrinated men are compared, it is found that the answers of regularly indoctrinated troops are generally bolder. In their answers to most

TABLE B1
INTERVIEW RESPONSES TO QUESTIONS 1, 2, 7, AND 8, SHOT 6

Question	Group	MILES					Not Quantified, %	Median, Miles
		1 and under	1.1 to 2	2.1 to 3	3.1 to 4	4.1 and over		
1. After an A-bomb burst over several pieces of equipment, how close to ground zero would you be willing to handle equipment before it is monitored? (Specify feet, yards, miles in response.)	Minimally Indotrained (N=55) ^a Regularly Indotrained (N=45) ^a	40	24	18	11	2	5	1.5
2. How close to ground zero would you be willing to be in a foxhole during an A-bomb burst? (Specify feet, yards, miles in response.)	Minimally Indotrained (N=55) ^a Regularly Indotrained (N=45) ^a	7	15	44	33	2	Don't Know, %	3
7. If you could take shelter under a tank, how near to ground zero would it be safe to be during an A-bomb burst? (Specify feet, yards, miles.)	Minimally Indotrained (N=55) ^a Regularly Indotrained (N=45) ^a	33	22	29	9	2	5	2
8. If you are in a tank, how near to ground zero would it be safe to be during an A-bomb burst? (Specify feet, yards, miles.)	Minimally Indotrained (N=55) ^a Regularly Indotrained (N=45) ^a	64	26	4	11	4	1	1

^aPercent of interviewees responding.

TABLE B2
INTERVIEW RESPONSES TO QUESTION 3, SHOT 6

Do you think your chance of coming out unharmed under atomic warfare is as good as under regular warfare? (Specify Yes, No, and Why)

	GROUP	
	Minimally Indoctrinated (N=55) Responses, %	Regularly Indoctrinated (N=45) Responses, %
Yes	47	51
	<u>Principal Reasons</u> 1. If training and equipment are O. K. 2. Regular warfare also dangerous	
No	49	47
	<u>Principal Reasons</u> 1. A-bomb more powerful, bigger, etc. 2. Radiation 3. Heat 4. Blast 5. Less protective equipment, less information, etc.	
Don't Know	2	2
Better	2	0
	——— 100	——— 100

of the questions, the regularly indoctrinated men expressed less fear of the A-bomb than the minimally indoctrinated men. This difference sometimes shows up in the median response for the group and sometimes is indicated by a willingness of a larger percent of the respondents to approach very close to the A-bomb in space or time. For instance, in Table B1, Question 2, the medians for both groups are at 3 miles. However, 22 percent of the regularly indoctrinated group, as compared with only 7 percent of the minimally indoctrinated group, would be willing to be in a foxhole 1 mile or less from ground zero during an A-bomb burst.

The remaining three questions in Table B1, all having to do with the distance a soldier is willing to be from ground zero, show consistent differences with greater boldness by troops with full indoctrination. The median (or middle) man was willing to handle unmonitored equipment 1/2 mile closer to ground zero if he had received full indoctrination, and he was willing to be twice as close to ground zero (1 mile as opposed to 2) in or under a tank than his counterpart with minimal indoctrination.

As Table B2 indicates, indoctrinated and non-indoctrinated troops are roughly evenly divided on the question of whether their chances of coming out unhurt in atomic warfare are as good as under regular warfare. Of those troops indicating that their chances were poorer, the reasons included all aspects of detonation—radiation, heat, blast, etc., and there did not seem to be any difference in this regard as a function of receiving the full indoctrination course.

Table B3 reports responses to a question which asks troops how soon they would be willing to move against the enemy following use of an A-bomb. In order to reduce the range of responses to a workable one, the times have been converted to logarithmic quantities. In addition, the upper limit of the distribution is given in its original form. While the median response for both groups is the same, more of the indoctrinated troops (35 percent) were willing to move in within 30 minutes than were minimally indoctrinated troops (16 percent).

Minimally indoctrinated troops tend to estimate the danger of the bomb to personnel as being greater than do regularly indoctrinated troops. This is indicated by the medians or internal distribution of responses to questions shown in Table B4.

Table B5 presents the first clear-cut reversal, shown by this interview study, in the tendencies of regularly indoctrinated troops to respond more boldly. Of these troops, 49 percent would prefer

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the protection of a heavy bunker, as opposed to 16 percent of the minimally indoctrinated troops. The median response is the same for both groups, a deep foxhole.

TABLE B3

INTERVIEW RESPONSES TO QUESTION 4, SHOT 6

Suppose an A-bomb is used against enemy troops by exploding it 2000 feet from the ground and all the enemy troops are killed. How soon could our troops move in? (Specify years, days, hours, minutes, in answer)

Log Minutes	Limit in Hours and Minutes	GROUP	
		Minimally Indoctrinated (N=55) Responses, %	Regularly Indoctrinated (N=45) Responses, %
0.00	less than 1 min	5	9
0.01 - 0.30	3 min	4	11
0.51 - 1.00	10 min	0	2
1.01 - 1.50	31 min	7	13
1.51 - 2.00	1 hr 40 min	45	36
2.01 - 2.50	5 hr 16 min	15	16
2.51 - 3.00	16 hr 40 min	0	2
3.01 - 3.50	52 hr	11	4
3.51 - 4.00	1 week	2	4
Not quantified		11	2
Medians		1 hr	

Table B6 indicates that a few more of the indoctrinated than minimally indoctrinated troops are willing to move in toward (or among) enemy positions immediately after an A-bomb burst. This is consistent with findings in Question 4, Table B3. Of interest

TABLE B4
INTERVIEW RESPONSES TO QUESTIONS 5 AND 6, SHOT 6

Question	Group	0	1-20	21-40	41-60	61-80	81-100	Don't Know, %	Median, Men
5. If 100 men were lying flat on the ground at 1/2 mile from ground zero of an A-bomb burst, would they probably be killed? (Specify <u>Yes</u> or <u>No</u> ; if <u>Yes</u> , how many?)	Minimally Indestructible (N=55) ^a	11	4	11	9	29	31	3	75
	Regularly Indestructible (N=45) ^a	11	3	16	20	9	33	9	50
6. If 100 men are standing on top of the ground 4 miles from ground zero during an A-bomb burst, afterward would they still be able to have sex relations? (Specify <u>Yes</u> or <u>No</u> ; if <u>Yes</u> , how many men?)	Minimally Indestructible (N=55) ^a	3	3	3	3	11	80	2	100
	Regularly Indestructible (N=45) ^a	3	0	9	4	7	78	9	100

^aPercent of interviewees responding.

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here are the reasons given by the troops for their answer. In two instances, the same reasons (reduced visibility caused by heavy dust, and confusion) are used as justification for both waiting and moving immediately. The more timid troops think of heavy dust

TABLE B5

INTERVIEW RESPONSES TO QUESTION 10, SHOT 6

What conditions would you want if you were going to be 1/2 mile from ground zero with an A-bomb burst 2000 feet in the air? Describe the smallest amount of protection you would want, whether concrete bunker, deep foxhole, lying on ground, standing up facing away from bomb. (Specify and describe).

Response Categories	Group	
	Minimally Indiscriminated (N=53) Responses, %	Regularly Indiscriminated (N=43) Responses, %
Behind wall or obstruction	0	7
Regular foxhole	25	13
Deep foxhole (over 4 ft)	43	31
Covered foxhole	14	0
Bunker made of logs, concrete, lead, etc.	16	45
Median Response	Deep Foxhole	Deep Foxhole

as a liability, whereas the bolder troops think of poor visibility in heavy dust as an asset. The timid troops concentrate on the confusions in friendly lines whereas the bolder troops cite the confusion among the enemy. This seems to point up possible differences in the perceptions of the defensively oriented and the aggressively oriented soldier.

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TABLE B6

INTERVIEW RESPONSES TO QUESTION 11, SHOT 6

Suppose an A-bomb is dropped on enemy positions in front of you, but not all the enemy is killed. Would it be better to go in through the dust and set up positions while the enemy can't see you? Or would it be better to wait for dust to settle before going in? (Specify which, or give any definite statements made)

Answer	GROUP	
	Minimally Indestricted (N=55) Responses, %	Regularly Indestricted (N=45) Responses, %
Wait for the dust to settle	76	71
	<u>Principal Reasons</u> 1. Radioactivity 2. Poor visibility 3. Our troops confused	
Go in immediately	22	29
	<u>Principal Reasons</u> 1. Enemy disorganized 2. Our troops couldn't be seen	

RESULTS: SHOT 8

Thirty men with previous experience in A-bomb maneuvers and 30 men without such experience were interviewed before participating in the Shot 8 maneuver. These interviews were obtained on D minus 2 and D minus 1 (30 and 31 May 1952) under roughly the same conditions as those described for Shot 6. The questions remained the same except that Question 9 was reworded to clear up the confusion that resulted from the original wording. The results appear in Tables B7 to B14.

TABLE B7
INTERVIEW RESPONSES TO QUESTIONS 1 AND 2, SHOT 8

Question	Group	Miles					Median, miles
		0-1.5	1.6-2.5	2.6-3.5	3.6-4.5	4.6 and over	
1. After an A-bomb burst over several pieces of equipment, how close to ground zero would you be willing to handle equipment before it is monitored? (Specify feet, yards, miles in response.)	Exper. (N=20) ^a	36	27	24	7	6	2
	Inexper. (N=20) ^a	13	33	17	22	13	2
2. How close to ground zero would you be willing to be in a foxhole during an A-bomb burst? (Specify feet, yards, miles in response.)	Exper. (N=20) ^a	10	17	33	37	3	3.2
	Inexper. (N=20) ^a	3	3	27	60	7	4

^aPercent of interviewees responding

TABLE B8
INTERVIEW RESPONSES TO QUESTION 3, SHOT 8

Do you think your chance of coming out unhurt under atomic warfare is as good as under regular warfare? (Specify Yes, No, and Why)

	G R O U P	
	(N=50), % Experienced	(N=50), % Inexperienced
<u>Distribution of Answers</u>		
Yes	13	49
No	47	60
<u>Reasons For "No" Answers</u>	No. 3	No. 3
Not enough know	6	8
Greater destruction	4	6
Radiation, etc.	1	3
No protection		
Total	14	18

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The results show a fairly regular difference between the two groups, and indicate that previous A-bomb experience tends to reduce fear of the A-bomb. The experienced group is willing to handle unmonitored equipment at 2 miles as compared with 3

TABLE B9

INTERVIEW RESPONSES TO QUESTION 4, SHOT 8

Suppose an A-bomb is used against enemy troops by exploding it 2000 feet from the ground and all the enemy troops are killed. How soon could our troops move in? (Specify years, days, hours, minutes, in answer).

	Group	
	Experienced (N=30), % ^a	Inexperienced (N=30), % ^b
<u>Distribution of Answers</u>		
0.0 - 0.5 hr	50	27
0.6 - 1.0 hr	33	13
1.1 - 2.0 hr	7	16
2.1 - 5.0 hr	3	10
5.1 -10.0 hr	0	7
over 10.1 hr	7	27
Median	0.8 hr	2 hr

^aThe time range for the experienced group was from 15 seconds to 24 hours.

^bThe time range for the inexperienced group was from 1 minute to 168 hours.

miles for inexperienced troops. Experienced troops would be willing to be in a foxhole 0.5 mile closer to ground zero, and would move into the bombed area 1.2 hours sooner. Experienced troops also believe that fewer men would be killed 1/2 mile from ground zero than do inexperienced troops. Either under or in a tank, experienced men feel they would be safer at shorter distances from the burst than do the inexperienced men.

TABLE B10
INTERVIEW RESPONSES TO QUESTIONS 5 AND 6, SHOT 8

Question	Group	Estimated No. of Men				Median, Men
		0-25	26-50	51-99	100	
5. If 100 men were lying flat on the ground at <u>X</u> mile from ground zero of an A-bomb burst, would they probably be killed? (Specify <u>Yes</u> or <u>No</u> ; if <u>Yes</u> , how many?)	Exper. (N=30) ^a	20	13	23	43	83
	Inexper. (N=30) ^a	0	10	16	73	100
6. If 100 men are standing on top of the ground 4 miles from ground zero during an A-bomb burst, afterward would they still be able to have sex relations? (Specify <u>Yes</u> or <u>No</u> ; if <u>Yes</u> , how many men?)	Exper. (N=30) ^a	0	0	3	97	100
	Inexper. (N=30) ^a	10	0	0	90	100

^aPercent of interviewees responding.

TABLE B11
INTERVIEW RESPONSES TO QUESTIONS 7 AND 8, SHOT 0

Question	Group	Miles					Median, Miles
		0-0.5	0.6-1.5	1.6-2.5	2.6-3.5	3.6 and over	
7. If you could take shelter under a tank, how near to ground zero would it be safe to be during an A-bomb burst? (Specify feet, yards, miles.)	Exper. (N=50) ^a	10	33	27	17	13	3
	Inexper. (N=50) ^a	3	20	27	27	23	2.6
8. If you are in a tank, how near to ground zero would it be safe to be during an A-bomb burst? (Specify feet, yards, miles.)	Exper. (N=50) ^a	10	37	23	13	17	3
	Inexper. (N=50) ^a	3	27	23	23	23	2.2

^aPercent of interviewees responding.

TABLE B12

INTERVIEW RESPONSES TO QUESTION 9, SHOT 8

Why do you think the Army is holding these answers?

	GROUP	
	Experienced (N=30), %	Inexperienced (N=30), %
Reasons		
Education of men	47	33
Learn effects and use in the field	40	53
Get it down pat	0	3
Possible future use to war	10	10
Can't see much in it	3	0

TABLE B13

INTERVIEW RESPONSES TO QUESTION 10, SHOT 8

What conditions would you want if you were going to be 1/2 mile from ground zero with an A-bomb burst 2000 feet in the air? Describe the smallest amount of protection you would want, whether concrete bunker, deep foxhole, lying on ground, standing up facing away from bomb. (Specify and describe.)

	GROUP	
	Experienced (N=30), %	Inexperienced (N=30), %
Degree of Protection		
Behind wall	0	3
Regular foxhole	20	37
Deep foxhole, 6 ft plus	17	17
Covered foxhole	20	10
Bunker, logs, concrete, etc.	43	43

TABLE B14

INTERVIEW RESPONSES TO QUESTION 11, SHOT 8

Suppose an A-bomb is dropped on enemy positions in front of you, but not all the enemy is killed. Would it be better to go in through the dust and set up positions while the enemy can't see you? Or would it be better to wait for dust to settle before going in? (Specify which, or give any definite statements made.)

	GROUP	
	Experienced (N=30)	Inexperienced (N=30)
<u>Distribution of Answers</u>		
Go in	$\frac{2}{77}$	$\frac{5}{60}$
Wait	23	60
<u>Reasons for Going In</u>		
Chances to get enemy	$\frac{No.}{6}$	$\frac{No.}{3}$
Enemy can't see you	4	5
Use dust as protection	5	1
Gas mask will protect	2	3
Keep enemy from reorganizing	8	0
	23 (77%)	12 (40%)
<u>Reasons for Waiting</u>		
Radioactivity	4	14
Could still get them later	1	1
Couldn't tell enemy position	1	2
See damage and whether it's safe	1	1
	7 (23%)	18 (60%)

Responses to questions shown in Tables B13 and B14 which ask for the soldiers' idea as to why the Army is holding the Desert Rock maneuvers, and what protection men would desire against an A-bomb, do not seem to show any consistent differences as a function of experience or inexperience.

APPENDIX C
THE QUESTIONNAIRE RESPONSES

CONTENTS

	Page
DESCRIPTION OF METHOD	93
RESULTS	98
TABLE	
C1. Mean and Percentage Scores for Questionnaire Clusters by Troops With and Without Previous A-bomb Experience	99

DESCRIPTION OF METHOD

Two forms of an attitude and information questionnaire, constructed by HUMRRO, were administered before and after D Day during Shot 8. Using HUMRRO's classification of questions, ORO was interested in whether (a) the answers of experienced troops differed from those of inexperienced troops to any of these groups of questions, and (b) answers to any of the clusters of questions changed significantly as a function of participation in the maneuver (before-after comparison).

The Subjects

The same troops used in the interview and polygraph studies in this shot were also given the questionnaire; to this group was added as many more subjects as could be obtained. Subjects were drawn from the 369th Engineer Amphibious Support Regiment, the 31st Transportation Truck Company, the 562d Transportation Staging Area Company, and the 360th Army Band. A total of 91 men formed the group who had had previous experience in an A-bomb maneuver; the inexperienced group comprised 40 men. The original classification into A-bomb experienced and inexperienced groups was made on the basis of company records. This classification was later checked with the statements of subjects regarding their previous maneuver experience, and a number of cases in which there were discrepancies were dropped from the analysis. Also, men who were present for only one of the two questionnaire administrations were dropped from the group. The questionnaire responses of the remaining 67 men with previous A-bomb experience and 30 men without previous experience are presented in this report.

Administration of the Questionnaire

The "before" test was given on D Day minus 1 at Camp Desert Rock, and the "after" test was given on the afternoon of D Day after the troops returned from the maneuver to Camp Desert Rock. Each test was given to all the men at the same time, in a mess hall, supervised by members of the research team and assisted by non-commissioned officers furnished by the military. As used in this study, the questionnaires were not anonymous; troops filled out an information sheet attached to the questionnaire, giving their name, unit, etc.

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Scoring of Questionnaire Responses

Since the questionnaire is not scored by item, but by clusters of items, some description is necessary to an understanding of their meaning. These 12 clusters together with examples of items which they contain, are as follows:

I. INDEX OF INFORMATION ACCURACY. In 26 questions the soldier is examined on the accuracy of the information he has concerning the A-bomb. The following question is an example:

52. What is the shortest time after an air burst at 2000 feet of an A-bomb that it is safe to walk through ground zero? (Check one)

- ☐ Immediately afterward
- ☐ 30 minutes afterward
- ☐ One hour afterward
- ☐ One day afterward
- ☐ Never
- ☐ Can't guess

II. INDEX OF UNDER-ESTIMATION OF EFFECTS. This index is obtained from certain of the alternative answers on five information questions and is scored as a minus quantity. Scores are weighed on the basis of deviation from accuracy in which accuracy equals zero. Thus a large minus number indicates greater under-estimation of effects. The first two alternatives of the following question serves as an illustration:

46. The blast effect of an A-bomb like the Hiroshima bomb, bursting height of 2000 feet in flat, open country, would not kill anybody beyond a distance of: (Check one)

- ☐ One-half mile from ground zero
- ☐ (the ground directly below the explosion)
- ☐ One mile from ground zero
- ☐ Three miles from ground zero
- ☐ Five miles from ground zero
- ☐ Can't guess

III. OVER-ESTIMATION OF EFFECTS. Certain alternative answers to 18 questions are scored as a plus quantity, and are weighed on the basis of deviation from accuracy. Accuracy equals zero. A low score indicates more correct concepts. The first three alternatives to the following question are examples:

51. Would radiation from an A-bomb explosion make men 4 miles away permanently sterile (unable to become fathers)? (Check one)

- ☐ Many men would be permanently sterile
- ☐ Quite a few men would be made permanently sterile
- ☐ Hardly any men would be made permanently sterile
- ☐ No men would be made permanently sterile
- ☐ Can't guess

IV. INDEX OF FEAR PRONENESS. The answers to seven questions are scored, giving more weight to less frequency of fear symptoms experienced by the subject during the past year. Therefore higher scores tend to indicate less proneness to fear. Question 24 is an example:

24. In the past year, were you ever troubled by your hands sweating so that they felt damp and clammy? (Check one)
- ☐ Very often
 - ☐ Often
 - ☐ Sometimes
 - ☐ Once in a great while
 - ☐ Never

V. PHYSICAL REACTION INDEX. Seven questions were used to measure the physical reactions of troops. High scores indicate lack of the physical reactions. Question 37c is an illustration:

37. Many soldiers have reported different physical reactions to various Army experiences. Have you yourself had any of the following reactions in the last day or so? (For each of the eleven reactions listed below, check one answer to show if you yourself had the reaction in the last day or so.)
- c. Sinking feeling in the stomach?
- ☐ Quite often
 - ☐ Several times
 - ☐ Only once or twice
 - ☐ Not at all

VI. INDEX OF DISBELIEF IN STATEMENTS OF PERSONAL DANGER. This index is divided into two parts: "Memory" and "Belief." In three questions the subject is asked to record what he remembers being told about the dangers of the A-bomb, and in three similar questions he is asked to record what he actually believes about the dangers, regardless of what he has been told. These questions are scored so that accuracy equals zero. Questions 68a and 69b illustrate parts a and b respectively:

68a. Have you been told how much or little danger you would be in if an A-bomb were exploded at 2000 feet and you moved into the spot directly below, one hour after the explosion? (Check one)

- ☐ Have been told I would be in great danger
- ☐ Have been told I would be in considerable danger
- ☐ Have been told I would be in a little danger
- ☐ Have been told I would be in no danger at all
- ☐ Do not remember what I was told on this

69b. Regardless of what you have been told on this, in how much or little danger do you actually think you would be if an A-bomb like the one at Hiroshima were exploded at a height of 2000 feet and you were 4 miles away, in a foxhole? (Check one)

- ☐ Think I would be in great danger
- ☐ Think I would be in considerable danger
- ☐ Think I would be in a little danger
- ☐ Think I would be in no danger at all
- ☐ Do not know what to think on this

VII. INDEX OF FAVORABLENESS TOWARD ONE'S OWN UNIT. High scores for this index reveal favorableness toward one's own unit. The five questions in this index are illustrated by Question 33 as follows:

33. Assuming your work would be the same, if you were going into combat would you rather go with your present company, or would you rather go with a different company? (Check one)

- ☐ Rather go with my present company
- ☐ Rather go with a different company
- ☐ Would make no difference to me

VIII. INDEX OF GENERAL ATTITUDE TOWARD ARMY.

This cluster consists of six questions which seek to identify attitudes toward the Army as a whole rather than specific attitudes toward one's own unit as in Index VII. High score indicates favorable attitude. The six questions that are included are illustrated by No. 15 as follows:

15. If you were offered an HONORABLE DISCHARGE today and if you knew you would not be drafted later, would you take the HONORABLE DISCHARGE? (Check one)

- ☐ I would certainly take it
- ☐ I would probably take it
- ☐ I would probably not take it
- ☐ I would certainly not take it

IX. INDEX OF CONFIDENCE IN ONE'S OWN PERFORMANCE. A high score in this cluster reveals greater confidence. Three questions were asked of which No. 17 is typical:

17. If you were sent into actual fighting now, how do you think you would do? (Check one)

☐ I think I would do all right

☐ I think I would have trouble at first, but after a

☐ while I would be all right

☐ I haven't any idea how I would do

☐ I don't think I would do very well

X. INDEX OF ATTITUDE TOWARD A-BOMB MANEUVERS. This index investigates the soldier's attitude toward the A-bomb maneuver. A high score indicates a favorable attitude. Number 73 is an example of the four questions comprising this cluster.

73. How much value do you think A-bomb maneuvers are in training troops for actual A-bomb combat?

(Check one)

☐ Very great value in training troops for combat

☐ Considerable value

☐ Some value

☐ Very little value

☐ No opinion

XI. INDEX OF FAITH IN ARMY. In contrast to Indices VII, VIII, and X which deal with the attitude of the subject toward the unit, the army, and the maneuver respectively, this index seeks to determine the degree of faith the subject has in the army and in the ability of the army and its experts to handle the A-bomb without undue danger to the soldier. A high score indicates a high degree of confidence in the army to carry out such a program. The following serves to illustrate the six questions in this cluster:

80. Do you think the experts know enough about A-bombs to use them in military maneuvers without danger to our troops? (Check one)

☐ Yes, enough to use them without any danger at all

☐ No, there would be a little danger to our troops in an A-bomb maneuver

☐ No, there would be a lot of danger to our troops in an A-bomb maneuver

☐ Can't guess

XII. INDEX OF EXPRESSED ANXIETY ABOUT A-BOMB. Various questions about the A-bomb are used to probe the subject's reactions and measure the degree of his anxiety. A high score indicates freedom from anxiety. Eight questions are in-

cluded in this cluster, of which the following two are illustrative:

89. If you were in a front-line foxhole, which would you rather have our airplanes drop on the enemy 2 miles from you? (Check one)

- ☐ An A-bomb
- ☐ Regular bombs
- ☐ Undecided

95. How do you think you yourself will feel about the different effects of the A-bomb just before the bomb goes off? (Check ~~one~~ answer for each of the four effects below)

- a. The fire flash (fireball)
 - ☐ Very scared of it
 - ☐ Quite scared of it
 - ☐ A little scared of it
 - ☐ Not at all scared of it

RESULTS

The questionnaire results, expressed in percentage of the maximum possible scores obtainable, are shown in Table C1. There are no significant changes in scores for any cluster for either experienced or inexperienced men as a function of participation in the maneuver. Although it is possible that troops did not change in any respect in their attitudes toward the bomb and its dangers as a result of having this experience, it may be that the instrument, together with its scoring scheme, is insufficiently sensitive to measure changes which possibly did occur.

In addition to showing no test-retest changes for either group, the questionnaire fails to show any significant differences between the experienced and inexperienced troops. One index, Accuracy of Information (I), seems to show a small consistent difference in that A-bomb experienced troops have slightly more accurate information (based on indoctrination material) than inexperienced troops. Even this difference is very small (10 percent) and probably reflects more contact with indoctrination procedures on the part of the experienced troops.

TABLE C2

MEAN AND PERCENTAGE SCORES FOR QUESTIONNAIRE CLUSTERS BY
TROOPS WITH AND WITHOUT PREVIOUS A-BOMB EXPERIENCE

Questionnaire Cluster	Maximum possible score	Troops with Previous Experience (N=67)				Troops without Previous Experience (N=38)			
		Before		After		Before		After	
		Mean	Max, %	Mean	Max, %	Mean	Max, %	Mean	Max, %
I	26 ^a	15.9	61	16.2	62	13.6	52	13.3	51
II	-11 ^a	-1.5	14	-1.6	15	-1.1	10	-1.2	11
III	49 ^b	7.8	16	8.6	18	8.6	18	9.2	19
IV	28 ^a	21.3	76	22.2	79	22.6	81	23.6	84
V	21 ^a	18.9	90	18.6	89	19.2	91	19.2	91
VIa	9 ^b	1.8	20	1.6	18	2.3	26	2.3	26
VIb	9 ^b	2.1	23	1.8	20	2.8	31	2.7	30
VII	15 ^a	8.8	59	8.6	57	7.4	49	7.6	51
VIII	6 ^a	1.6	27	1.6	27	1.9	32	1.9	32
IX	9 ^a	5.5	61	5.7	63	5.7	63	6.1	68
X	11 ^a	9.3	83	9.5	86	9.0	82	9.4	85
XI	12 ^a	7.0	58	7.3	61	5.9	58	6.7	56
XII	16 ^a	10.7	67	10.9	68	9.7	61	10.5	66

^aHigh numbers indicate more knowledge, greater confidence, lack of fear, underestimation of effects, satisfaction with unit or Army.

^bHigh numbers indicate overestimation of effects, less confidence.

APPENDIX D
THE PERFORMANCE TEST

CONTENTS

	Page
DESCRIPTION OF METHOD	103
RESULTS	105
TABLE	
D1. Time Required by 25 Participants to Dis- assemble and Reassemble the M-1 Rifle	106

In Exercise DESERT ROCK I it was found that troops performed routinely; there was no indication that participation in the A-bomb maneuver was stressful enough to result in any impairment of troop performance. Although no systematic attempt was made to study the overt behavior of troops during the DESERT ROCK IV Exercise, ORO staff members who attended the maneuvers collected incidental information on D Day, and after each maneuver questioned officers concerning the behavior and performance of their troops during the maneuvers. On the basis of such information, no evidence was obtained which would indicate that troops performed inadequately. As in the first exercise, troops apparently performed in a routine manner and gave no outward signs of fear.

DESCRIPTION OF METHOD

Although the A-bomb explosion apparently had no detrimental effect on the ability of troops to perform routine maneuver operations, it was felt that tensions might exist which might be reflected in changes in troops' ability to perform military tasks involving manual dexterity.

On rehearsal day for Shot 3, a group of 25 men performed the selected task as a "before" test, and on D Day the second test was given to the same men within an hour after the burst, before the men moved toward ground zero. This is the critical time for troops to perform their military duties. If anxiety or emotional disturbance was induced, as a result both of the explosion they had just witnessed and of the anticipated maneuver in the burst area, it is important to ascertain its degree and effect.

Administration of the Test

The subjects of the study were riflemen (11 EM and 14 non-coms), the 3d platoon of B Company, 165th Regiment, 31st Infantry Division. A second group of 25 riflemen from this company, and two more groups of 25 and 24 men respectively, including riflemen, bazooka men, automatic riflemen, and machine gunners from the 504th Airborne Infantry Regiment were also tested prior to the burst; on D Day, however, time did not allow for a retest of these additional groups immediately after the A-bomb explosion.

The task, to field strip and reassemble the M-1 rifle, was selected because it was a military task involving the use of weapons, and one in which infantrymen could be expected to be

skillful, and in which the degree of learning through repetition in the course of the test would, presumably, be minimal. At the same time the task had relevance to combat performance, it was simple to structure, and involved a coordination of muscular activity which could be affected by anxiety or tension. The men were given the following instructions:

"Each man is to have his M-1 rifle. You will have your light field pack on your back during the test. First I will tell you how we do it and then we will show you by having a soldier go through it just as you are to do. Your own officers will give the commands. . . you are to stand at ease in back of the benches laid out in your position, facing the camera. You will be called to attention and then brought to 'Post Arms.' Then you will be given the command, 'Begin test.' You will immediately drop to your knees on the benches and start stripping your rifle down--as far as we show you. Lay all rifle parts on the benches. (Your officers will watch to see that everybody does the job completely.) As soon as you have finished taking the rifle apart--stand up and drag the benches back three feet. Then without any delay, reassemble the rifle. As soon as you have finished putting the rifle together again, stand up at attention on the benches and 'Post Arms.' Hold post arms until everyone in your group has finished. When the test is complete you will be given the command to 'Fall Out'. . . Don't practice up on this job. We want to find out how long it takes to do this task when you have not practiced--just as you are now."

The officer then directed a corporal through the demonstration of the test.

A spirit of competition was introduced for motivation; all four groups were present throughout the entire test so that each test group was observed by the others. The men were told:

"We want you to do this job as fast and as well as you can. We will time you and take movies. The movies and time records will be used back in Washington. . . We are going to check your speed against others in your own outfit. We will also compare outfits to see whether National Guard, Regular Infantry, Airborne, Marines--or what have you, show up best. Some of these pictures will be used in a movie to be made of the whole exercise."

The presence of competing groups, who commented freely on the performing group's activities, constantly prodded the individual soldier to maximum performance, both for personal reasons and because of pride in his unit and branch of service. Evidence of such a concern is attested by the film record which frequently shows soldiers, who had finished assembling their rifles, turning around to determine the progress of a slower soldier.

In order to facilitate the timing of each man, the troops performed the test in two semi-circles before a movie camera. The camera was mounted on a truck so as to allow for a clearer view

of each man. Movies of each test were taken from just prior to the command to disassemble until all members of the group had completed the performance.

Measurement of the Film Record

This permanent record, taken at the rate of 90 feet of 35 mm film per minute, was made available for study in 16 mm black-and-white prints. By selection of the frames marking the beginning and completion of each operation by each man and measurement of the intervening film, the time interval was determined. Since 90 feet of 35 mm film has the same number of frames (1440) as 36 feet of 16 mm film, the problem of conversion was a simple ratio of 5 to 2.

For reading purposes the following terminal points were established for operation:

1. The point at which each subject began to assume a kneeling position on the poncho was used as the starting point for disassembly.
2. The point at which each subject started into position for the purpose of pulling back the poncho was taken as the moment his disassembly was completed.
3. Beginning of reassembly was established as the point at which each subject reached for the first rifle part.
4. When the individual subject started into position for port arms (usually from a kneeling position) it was concluded that assembly was complete. The total actual performance time for each subject was computed by adding the disassembly to the reassembly time.

RESULTS

Because of time limitations, there was no opportunity to determine the reliability of the performance test before it was used at Desert Rock. It was recognized that if the test were highly unreliable, if there were many and wide discrepancies between scores made on different administrations of the test under standard conditions, then the "before" and "after" A-burst results would have little meaning. It was assumed, however, that even if the test itself were unreliable, severe tension and emotional disturbance following the explosion might result in an appreciable lengthening of the time required by the group to

perform the task.* The test data shown in Table D1 indicate that such was not the case; after the A-burst the group performed the task somewhat more quickly, rather than more slowly. The small, and probably insignificant, decrease in range, standard

TABLE D1

TIME, IN SECONDS, REQUIRED BY 25 PARTICIPANTS TO
DISASSEMBLE AND REASSEMBLE THE M-1 RIFLE

	Mean	Range	Standard Deviation
Before the Burst	119.4	100(83-271)	34.0
After the Burst	113.6	125(75-200)	28.8

deviation, and mean time required to complete the task during the retest (after the burst) would seem to indicate that any increment in skill because of recent practice of the task was not overshadowed by anxieties and tensions related to the A-bomb. Witnessing an A-bomb explosion apparently did not reduce the ability of troops to perform this military task.

*Unfortunately it was impossible to correlate the scores obtained by subjects in the first and second tests, because some of the subjects had changed their places on the second test which prevented accurate matching.

APPENDIX E

**OTHER STUDIES OF THE REACTIONS
OF INDIVIDUALS TO AN ATOMIC EXPLOSION**

CONTENTS

	Page
DESERT ROCK I STUDIES	109
INDEPENDENT INVESTIGATIONS: DESERT ROCK IV	110

DESERT ROCK I STUDIES

Only recently has any systematic attempt been made to assess the psychological reactions of individuals to an atomic explosion. In Exercise DESERT ROCK I, the first use of an actual A-bomb in troop maneuvers, two coordinated research studies were undertaken to investigate the behavior, reactions, and attitudes of troop participants. One of these studies was concerned primarily with troops' attitudes and knowledge about atomic effects.* Questionnaires designed to obtain such information were administered to groups of participant troops (chiefly paratroopers), as well as to comparable groups of non-participants, at several points of time before, during, and after the exercise at Desert Rock. Analyses of the questionnaire data indicated that the atomic energy indoctrination given before the D Day maneuver (at home camp and at Desert Rock) resulted in a sharp increase in troops' factual information about atomic warfare, particularly in information relating to self-protection measures. Participation in the maneuver itself did not result in a further gain in atomic information. It was hypothesized that anticipation of the A-bomb experience perhaps served as a stimulus to learning of indoctrination materials, and that the actual maneuver experience aided in the reinforcement and retention of atomic information by participant troops. Findings relating to the extent to which the indoctrination and the maneuver increased confidence and reduced anxiety and fear in the participating troops were less clear-cut. There were apparently some indications that indoctrination and the maneuver increased men's self-confidence; as troops were indoctrinated and given first-hand experience with the A-bomb, some of their fears were reduced. There were other indications, however, that considerable anxiety about some of the bomb's effects persisted.

In another investigation undertaken during DESERT ROCK I† other methods of assessing troop reactions to an atomic explosion were used. These included observational studies of troop performance during the maneuver, intensive interviews with participant troops, an information survey conducted after the maneuver, and a polygraph study designed to measure the involuntary physiological reactions of troops to various questions

*Joint Report: Attitude Research Br., AFHS Div, DD, and Attitude Assessment Br., TIEB, DIA, DA, A Study of Soldier Attitudes and Knowledge About Atomic Effects - Exercise DESERT ROCK, Feb 1952, RESTRICTED; also Human Resources Research Office, HUMPRO-TP-1, Desert Rock I - A Psychological Study of Troop Reactions to an Atomic Explosion, Feb 1952, RESTRICTED.

†Operations Research Office ORO-T-170. Troop Performance on a Training Maneuver Involving the Use of Atomic Weapons, March, 1952. SECRET.

relating to the A-bomb and the maneuver. The results of these studies indicated that troops performed routinely on D Day and showed no visible signs of fright. However, significant tension was found to exist among troops prior to the maneuver. Although troops verbally expressed considerable confidence in their safety, their physiological reactions indicated some degree of emotional disturbance. After participation in the maneuver this tension was found to be reduced.

INDEPENDENT INVESTIGATIONS: DESERT ROCK IV

Exercise DESERT ROCK IV provided further opportunity to assess troop reactions to an atomic explosion. Several independent investigations were undertaken during this exercise. In the Shot 4 maneuver involving the participation of Marine units, a research team attempted to determine if the psychological reactions of the troops were sufficient to require further study.* The nature of the data gathered by this team was purely observational; observations were made and impressions gained at first hand while participating in the exercise with the troops. The investigators found that troops did not exhibit observable fear or anxiety reactions except for a brief period before the burst, and immediately before the drop when emergency procedures were announced over the loudspeakers.

It was concluded that there was no need of further study of psychological reactions of troops, if "psychological reactions" is taken to mean fear and anxiety reactions, and if subsequent exercises are repetitions of the one under study. It was further concluded that such goals as were actually attained in this exercise might be better and more cheaply attained by means of a systematic training course; however, it was considered even more desirable to improve the atomic exercise in order to provide a real tactical training laboratory in atomic warfare. It was suggested that this might be accomplished by increasing the realism of the exercise, introducing conditions of fear and fatigue, and by introducing tactics into the maneuvers.

During Exercise IV a survey of troops' attitudes and opinions was made by Desert Rock staff personnel participating in discussion groups and small informal meetings.† Six companies of station

* Technical Report, Series 1952, Institute Report No. 7. Institute for Research in Human Relations. Adjustment of Troops to Atomic Explosions, 1 July 1952. RESTRICTED.
† Source report, op. cit., p 10-11.

complement personnel were surveyed. It was found that fears of radiation effects exceeded all other fears connected with atomic bursts, and all groups indicated a desire for additional information on effects of atomic radiation. Troops reported that they felt less fearful of the A-bomb after receiving indoctrination and witnessing an atomic burst. A large majority of men said they would be willing to remain in entrenchments 2 miles from ground zero in maneuvers similar to those in Exercise IV.

In addition to the present investigation of troop reactions in Shots 3, 6, and 8 of Exercise IV, another rather comprehensive study was undertaken in Shot 6, in which armored infantry units participated.* Data on troop attitudes and information concerning the A-bomb were collected by means of questionnaires, and certain measures of psychological and physiological reaction were also obtained. Preliminary findings from this study indicate that, as a result of the special indoctrination at Desert Rock, troops showed a sharp gain in information about many aspects of atomic effects, particularly those which had to do with personal injury. Participation in the maneuver itself, however, resulted in no further gain in troops' level of information, and apparently even led to a loss of information on a number of specific points about atomic effects. No evidence was obtained that fear made any of the participants incapable of carrying out their duties almost immediately after the atomic burst. However, it was found that a large majority of troops did reveal some anxiety or tension during the course of the exercise.

*Human Resources Research Office, HRRRO-TR-2, DESERT ROCK IV - Reactions of an Armored Infantry Battalion to an Atomic Bomb Maneuver, Aug 1953. RESTRICTED.

APPENDIX F
METHODOLOGICAL CONSIDERATIONS

CONTENTS

	Page
PROBLEMS IN TECHNIQUE	115

[REDACTED]

Physiological measurements of one kind or another have been widely used by the Army and by its research agencies. For example, the Criminal Investigation Division of the Adjutant General's Office has used polygraphs measuring circulatory and respiratory changes to indicate deception during the interrogation of prisoners. Similar polygraphs are used in screening employees of the Armed Forces' various agencies with a view toward detecting disloyal or dishonest workers. In addition to the physiological indicators in the present study, HumRRO has used two separate methods of measuring the amount of palmar sweat in troops reacting to the Desert Rock exercise. ORO field teams have used changes in blood chemistry and urine as an index of stress and fatigue in troops in Korea.

PROBLEMS IN TECHNIQUE

The above list is not intended to be exhaustive but illustrates the diversity of measures that have been used in military agencies for the purpose of assessing emotional experience. Since physiological measures seem to be playing a role in Department of Defense operations and research, it seems appropriate to point out some of the questions about these techniques which were raised in the course of the present study, and which might be answered by basic research.

1. What forms of physiological response are the most appropriate measures of particular kinds of emotional experience? What physiological responses are the most valid indicators of deception? What are the most valid indicators of fatigue? etc.
 2. Is it possible, through measures such as beat-to-beat variability of heart rate, blood flow, muscle action potentials, and so forth, at present largely unexplored, to differentiate between one emotion and another? The kinds of measures which were used in the present study do not differentiate, for example, between fear and anger. Under some conditions it might be very important to know whether a particular situation aroused fear to the point where it limited combat effectiveness or anger which might facilitate good combat performance.
- [REDACTED]

[REDACTED]

3. What is the most appropriate experimental design when physiological measures are used as they are in the present study?

- a. Individuals differ greatly in their general physiological responsiveness; how large a sample is necessary to insure a random distribution among the experimental groups?
- b. Is a systematic bias introduced when incomplete records are discarded? Many records are incomplete because of movements on the part of the subject; is the person who moves about during the test more or less responsive than one who does not?
- c. What is the appropriate statistical technique when repeated physiological measurements are made on the same person?
- d. What is the rate of adaptation to the measuring technique? To what extent do questions at the beginning of the test elicit larger responses than those toward the end of the test?
- e. Is the subject responding to a single word in the test question, like "A-bomb," or is he responding physiologically to the entire question?

It is suggested that if this kind of measurement is to have continued use in military research, some consideration be given to these and other basic methodological questions.